Plastics

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I.C.I. PLASTICS

Serve the Aircraft Industry

The prototype Comet II. *Photo. by courtesy of the De Havilland Aircraft Co. Ltd.*

There are few British aircraft in which I.C.I. plastics are not used somewhere, whether it be in the manufacture of radomes for night fighters, or p.v.c. fabric for the interior decoration of new airliners.
I.C.I. Plastics have contributed much to the success of the De Havilland Comet—the world's first jet airliner.

The plastics widely used in this aircraft are:

'PERSPEX'—acrylic sheet for pressurised cabin windows (including inner framing), lighting fittings, toilet fitments, accessories, etc.
Advantages: ease of fabrication, low weight, toughness, excellent weathering properties.

'ALKATHENE'—brand of polythene for radar cable insulation.
Advantages: low power factor, lightness in weight, ease of extrusion.

'WELVIC'—polyvinyl chloride for electric cable insulation.
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'FLUON'—polytetrafluoroethylene, a special high-frequency dielectric.
Advantages: unaffected by high temperature or corrosive fluids.

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IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1.
Export enquiries should be addressed to: IMPERIAL CHEMICAL INDUSTRIES LIMITED, Plastics Division, Black Fan Road, Welwyn Garden City, Herts., England.

P.521

it's no secret . . .

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Delivery Service: *Count on this to be absolutely exceptional. We promise you the best timetable in the Plastics business—and keep to it (which is, perhaps, more surprising). Just ask us to prove it.*

Meticulous Accuracy: *We welcome orders for intricate mouldings and guarantee accuracy in all our production. However close the limits imposed we will work to them. Examples of mass-quantity with fine-limit accuracy are the millions of barrels we produce annually for Platignum Fountain Pens. May we have your inquiry or invitation to call?*

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Wickman

for

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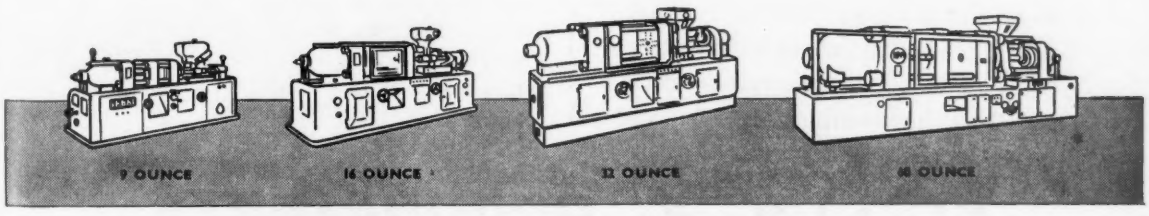
INJECTION MOULDING MACHINES



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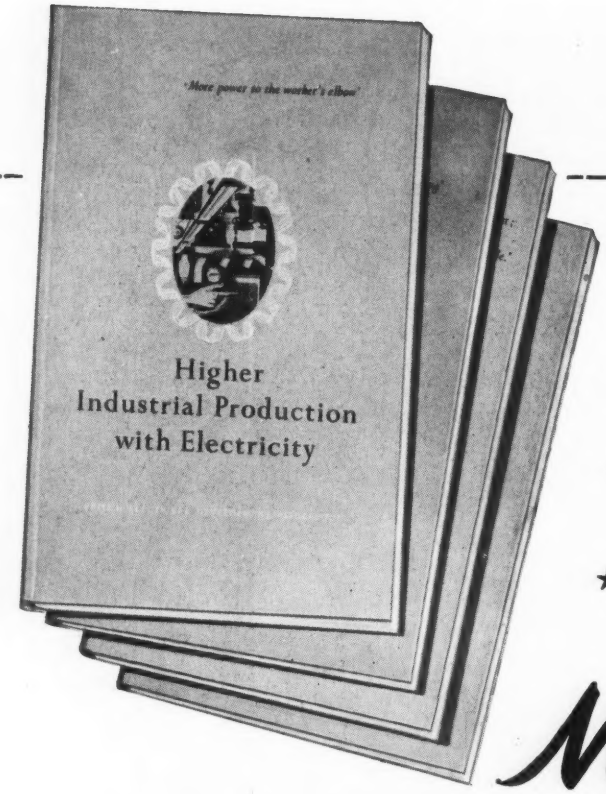

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The post-free price of each of the books is 9/- and copies can be obtained from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2, or from your Electricity Board.

The Association has produced a film called "A Case for Handling" which illustrates by practical demonstration the vital part that improved materials handling can play in all industries. It runs for 32 minutes, and is available on free loan.

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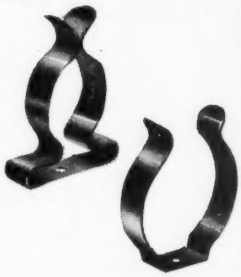

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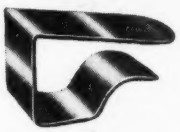

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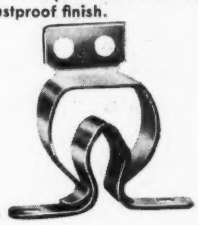

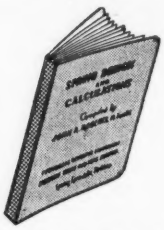

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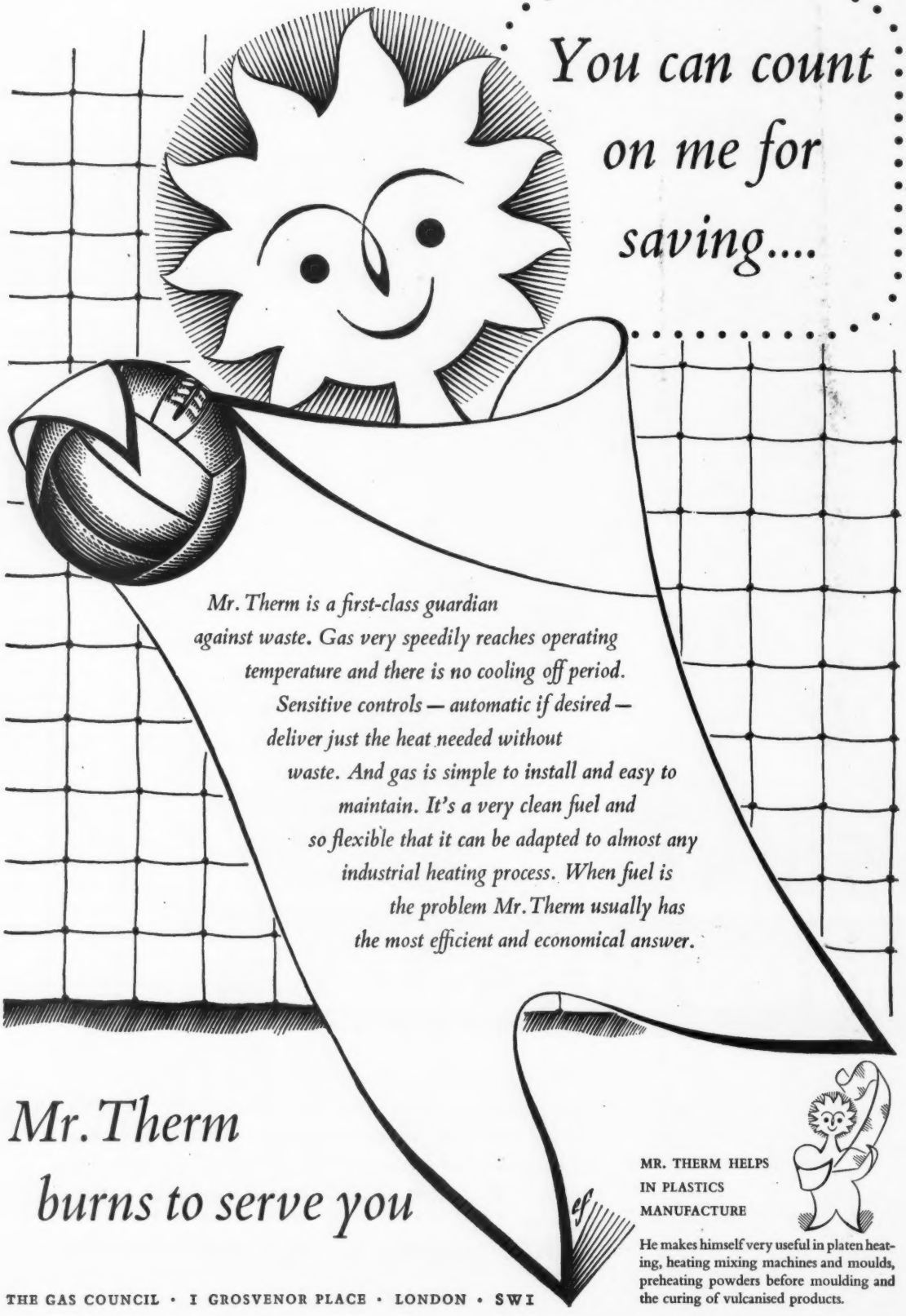

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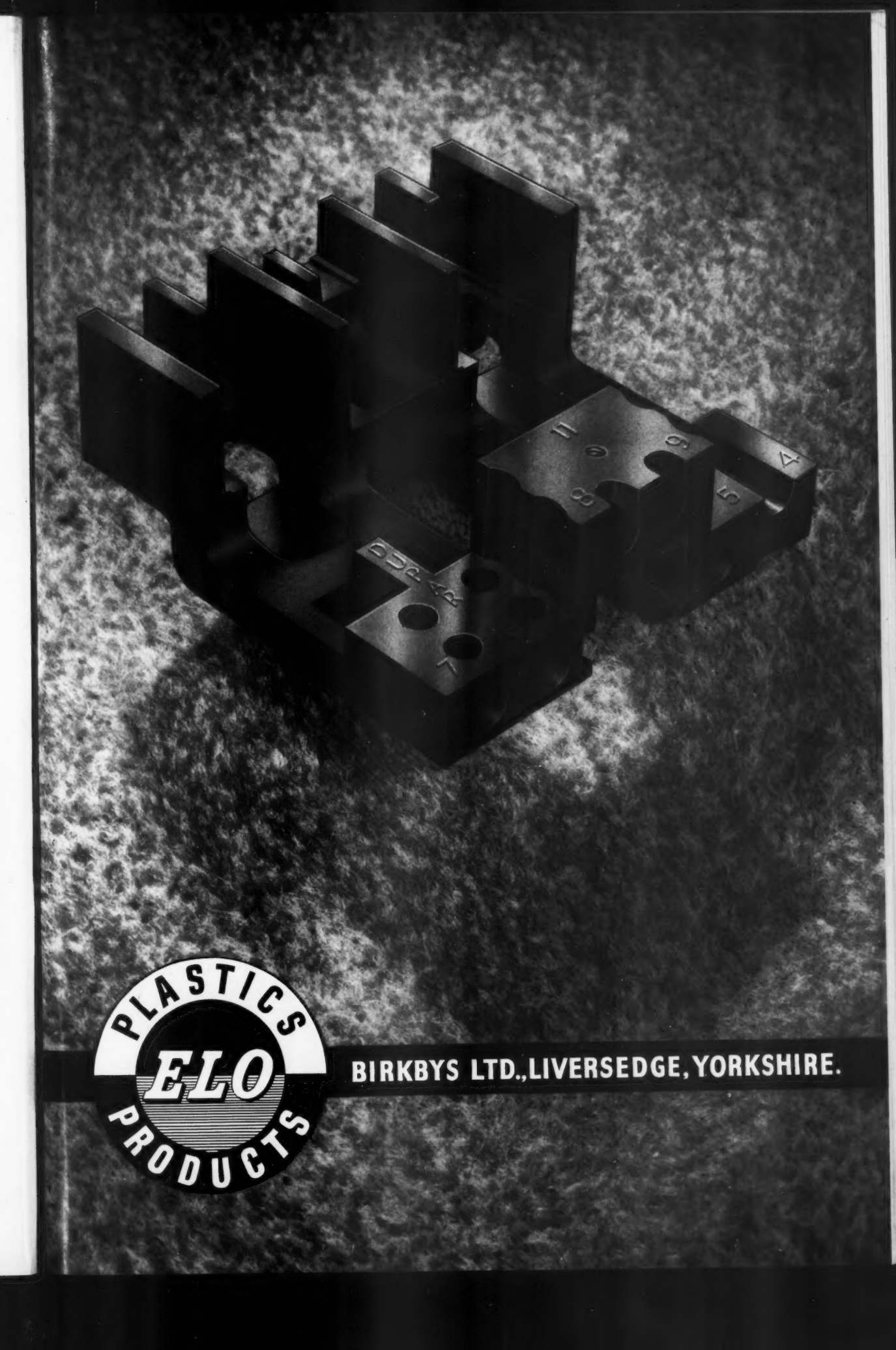
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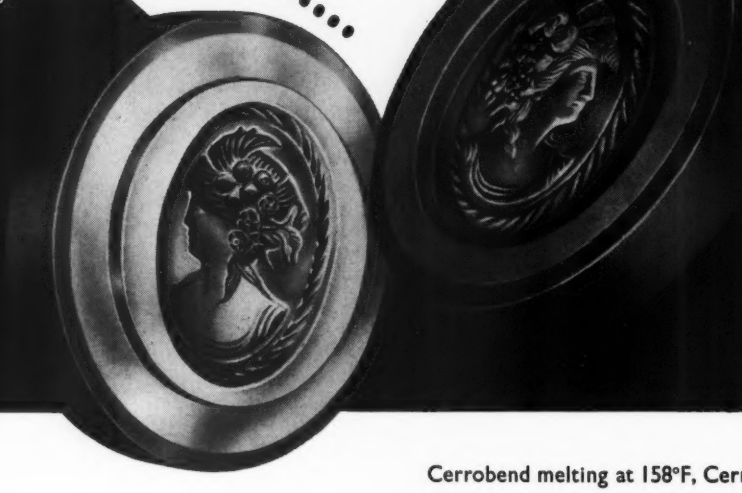

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Low-Temperature-Melting Non-Shrinking Alloys **ALLOYS**

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High purity solvent in the formulation of surface finishes.

Typical analysis:

Distillation range: 98% by vol. between 55.5 and 56.5°C.

Acidity as acetic acid: 0.0005% by wt. maximum.

Permanganate fading time: more than six hours.

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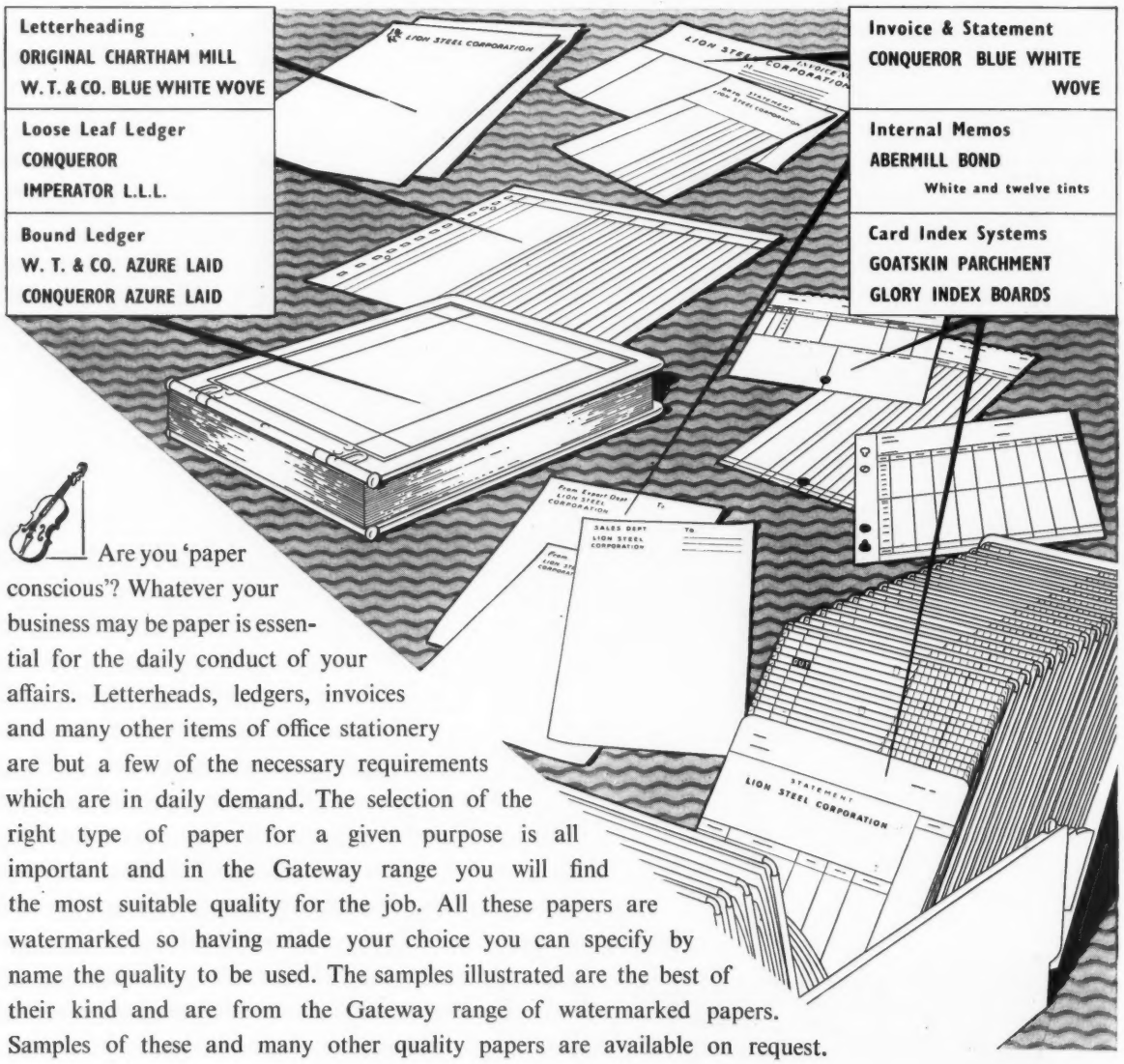

Are you 'paper conscious'? Whatever your business may be paper is essential for the daily conduct of your affairs. Letterheads, ledgers, invoices and many other items of office stationery are but a few of the necessary requirements which are in daily demand. The selection of the right type of paper for a given purpose is all important and in the Gateway range you will find the most suitable quality for the job. All these papers are watermarked so having made your choice you can specify by name the quality to be used. The samples illustrated are the best of their kind and are from the Gateway range of watermarked papers. Samples of these and many other quality papers are available on request.

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. . . to play the "SELCOL HURDY GURDY" and it needs no skill or experience and very little effort to produce a tune.

You can't make moulds however, by just turning a handle, it demands a vast amount of skill and experience plus some quite elaborate plant. Even then if you want to make really good tools, you've got to add a real interest in a customer's project and I'm sure it is just this combination which has enabled us to tool successfully so many of the "tricky" mouldings you see around.

Fifteen different plastic mouldings are used in this attractive and tuneful toy, moulded by Thames Valley Moulders, Ltd., for Selcol Products, Ltd., on Peco 8-oz. injection machines.

It has a realistic tone and a repertoire of tunes is provided by means of the rapidly changed paper disc records.

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Cap in NYLON

manufactured for and shown by courtesy of The British Thomson-Houston Company Limited—yet another of our wide range of injection mouldings in all thermo-plastic materials.

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INJECTION MOULDING *Specialists*

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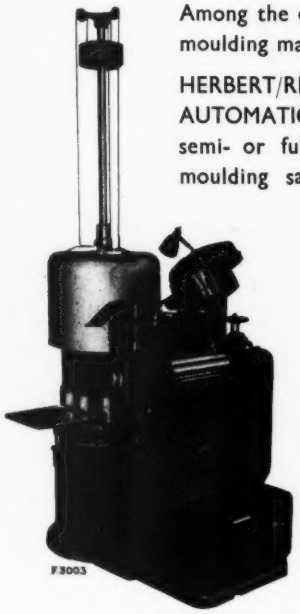
INJECTION AND COMPRESSION MOULDING MACHINES



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Among the extensive range of high-quality injection and compression moulding machines we can offer are :—

HERBERT/REED-PRENTICE 10D-8/10 oz. and 5A-4 oz. FULLY-AUTOMATIC INJECTION MOULDING MACHINES. Either manual, semi- or fully-automatic cycle. Can be fitted with low pressure moulding safety device, plunger advance mechanism, double-shot plunger and a special nozzle for Nylon moulding.

EDGWICK 'HY' FULLY-AUTOMATIC INJECTION MOULDING MACHINE. Self-contained, fully-hydraulic moulder with 1½ oz. capacity. Manual, semi- or fully-automatic cycle.

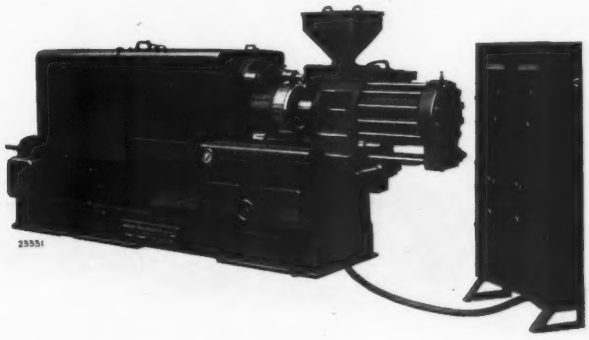
DANIELS 100-TON LOW-PRESSURE PRESS. The first of a range of hydraulic presses for reinforced plastics. Tables are 4 ft. × 3 ft. Daylight 7 ft. and stroke 4 ft.

DANIELS 100-TON ENCLOSED-TYPE PRESS. A semi-automatic press fitted with a Daniels automatic process timer to control moulding cycle.

DANIELS 2B PREFORMING MACHINE. Tablets up to 1½" diameter and from 20 to 60 per minute can be produced. Handles most grades of phenolic and urea powders and certain types of melamine.

DANIELS 100-TON LOW-PRESSURE PRESS FOR GLASS-FABRIC MOULDING

EDGWICK 'HY' INJECTION MOULDING MACHINE (SEMI-AUTOMATIC TYPE)



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Designer's Diary N°10

Reprints of these announcements will be gladly supplied on request.

B.I.P. designers contend that, in handle design especially, styling must logically be dictated by functional requirements. Accordingly most of the handles shown are hand-sculptured to suit the grip. A number of simple technical improvements are suggested which in no way restrict the designer. All the items are suitable for moulding from Beetle materials:

Pull Handle—vertical pull—whole hand

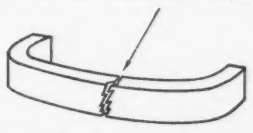
By using a hollow section and taking the shank of the eyelet right through the thickest part of the moulding, maximum strength of attachment is achieved. The hollow section also saves material, reduces curing time.

Drawer Handle—horizontal pull with finger-tips

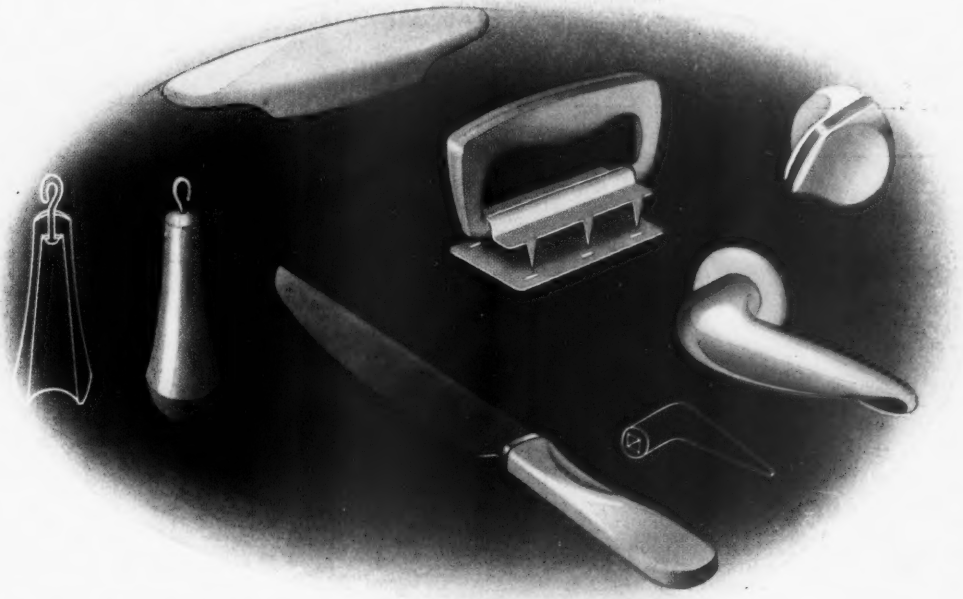
Moulded hollow from back to face. The cambered form of the top face is stronger than would be any bar-type handle made from the same material.

Case Handle—vertical pull—whole hand

Made in a split mould and 'crowned' to facilitate flash removal. The lower part of the moulding, as shown, consists of a solid bar which with its cover-plate comprises a simple single-hinge arrangement. Stronger and easier to assemble than the conventional double hinge.



Moulded bar-type drawer handle



Cooker Control Knob

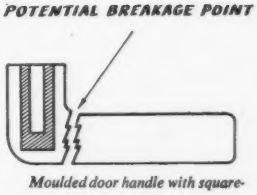
No major problems. The decorative band conforms with current cooker design trends.

Door Handle—twisting action—whole hand

Hand-sculptured for natural grip. The tapering of the die-cast insert removes a potential breakage point such as is naturally offered by the usual square-ended insert.

Bread-Knife Handle—full grip with thumb pressure

Hand-sculptured for positive control. By repeating the same form on either side, the handle is suited both to right and left-handed users.



Moulded door handle with square-ended insert

The B.I.P. Technical Advisory Service is always ready to help moulders in any problem which may arise regarding product design, mould design, materials and moulding techniques. This consultative service is freely offered, without obligation, and applies to moulding in thermoplastic as well as thermosetting materials.

BRITISH INDUSTRIAL PLASTICS LIMITED B·I·P GROUP **1 ARGYLL ST., LONDON, W.1**

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NESTORITE	GRADE A·803
ELECTRICAL LOW LOSS	
Filler	Mica
Particle Size (inches)	1/10
Specific Gravity	1·90
Bulk Factor	2·4—2·7
Powder Density	·70—·80
Time of Cure of Test Cup (secs.)	90—110
Recommended flow range	5—8
Shrinkage (thou./inch)	0·2—0·8
Flowability (cm.)	7—9
Impact Strength (ft./lb.)	·13—·23
Tensile Strength (lb./sq.in.)	4,800—5,800
Elastic Modulus in tension (lb./sq.in.)	2×10^6
Water Absorption (7 days) (mg.)	20—40
Plastic Yield Grading (°C.)	140
Blister Temperature (50°C. per hr. rise)	160—170
Shrinkage after heating 5" disc for 24 hrs. at 140°C. (thou./in.)	0·3—0·4
Electric Strength at 90°C. minute value (V/mil.)	300—400
Surface Resistivity after immersion ($\log_{10}$ohms)	11·0—12·5
Volume Resistivity (as moulded) ($\log_{10}$ohm cm.)	13·0—14·5
Power Factor at 10^6c/s.	·008—·010
Permittivity at 10^6c/s.	5·0—5·4

The best electrical material. Relatively easy moulding and mouldings have fairly good strength. Low shrinkage. Dimensionally stable at temperatures below 160°C.

YOU'RE RIGHT WITH "NESTORITE"

Problem Children . . .

The ancient deities, Uranus and Gœa, who resided on the summit of Mt. Olympus, had the misfortune of having an offspring of 18 children all so gigantic and terrifying that for safety-first reasons they were imprisoned in an abyss by their frightened parents.

Three of the huge brats—Brontes *Thunder*, Steropes *Lightning* and Arges *Sheet Lightning* were irresistible in their electrical energy. There were, of course, at that time, no Regional Electricity Boards to control them and no hardy materials to stand-up to them. The consequences were somewhat unfortunate!

* * *

Today, in the Plastics Industry, there are also "Problem Children" (surnamed "Mouldings") requiring careful "bringing-up" to ensure robust physique completely proofed against all Electrical contingencies.

"Nestorite" Service has developed a special range of proved and tested Powders for such purposes, of which the appended formula is typical.

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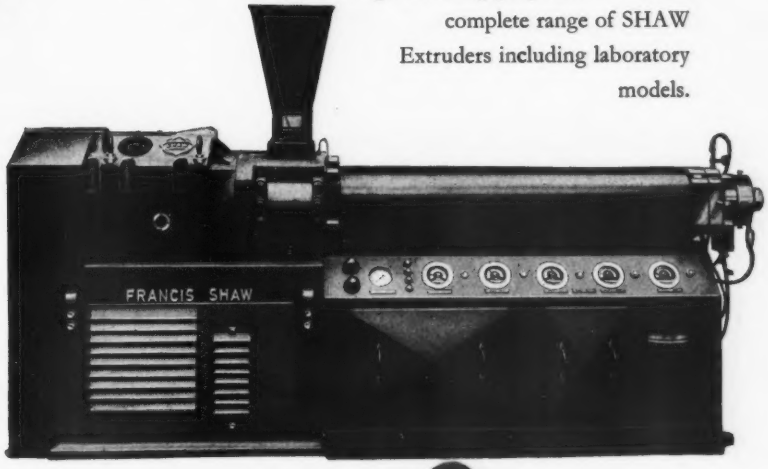
for extrusions like these . . .

The Shaw 4½" Plastic extruder is specially designed for the continuous production of belting, tubing, miscellaneous sections and for the insulating and sheathing of cables. Also suitable for processes requiring the delivery of a regulated amount of milled and molten materials for sheeting or coating purposes. There is a complete range of SHAW Extruders including laboratory models.



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When it's a question of plastic or ebonite mouldings there's always a Lorival answer. They're lively lads at Lorival, with technique and imagination. They put a beautiful finish on their products, and they offer you pleasing design, keen prices and rapid delivery. You can safely leave it to them.

PAPER-FILLED UREA MATERIAL is the ideal medium for this Bathjoys Display Stand for Reckitt & Colman Limited. The design is rigid, yet without heavy sections, and the moulding is produced in one piece by the compression method. The colour chosen was cream, and recessed lettering in the front, filled in with green wax, provides a striking contrast.

LORIVAL PLASTICS

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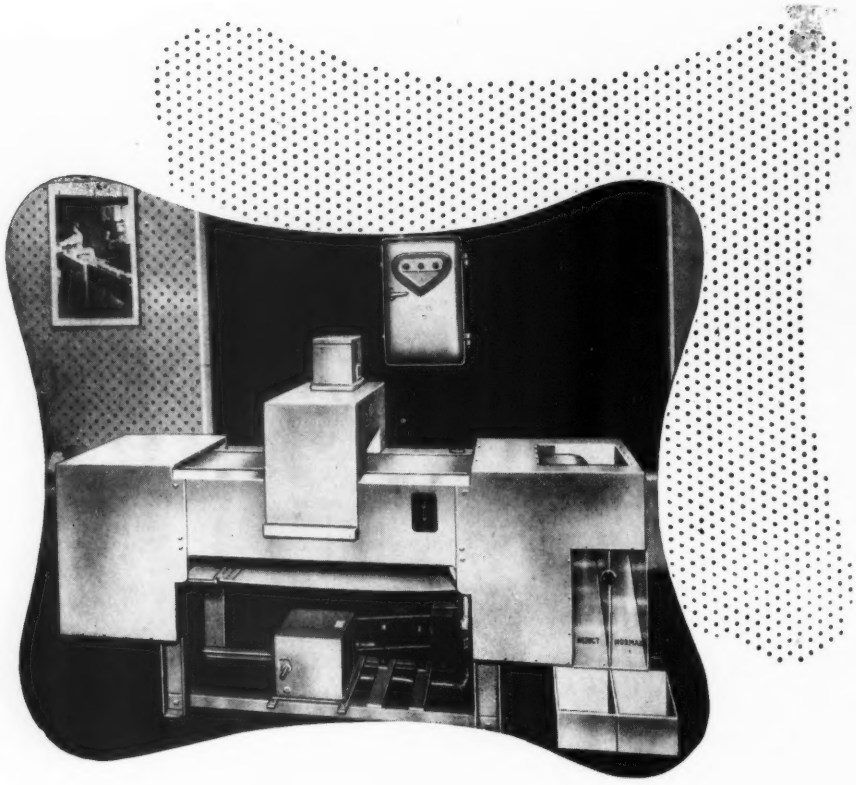

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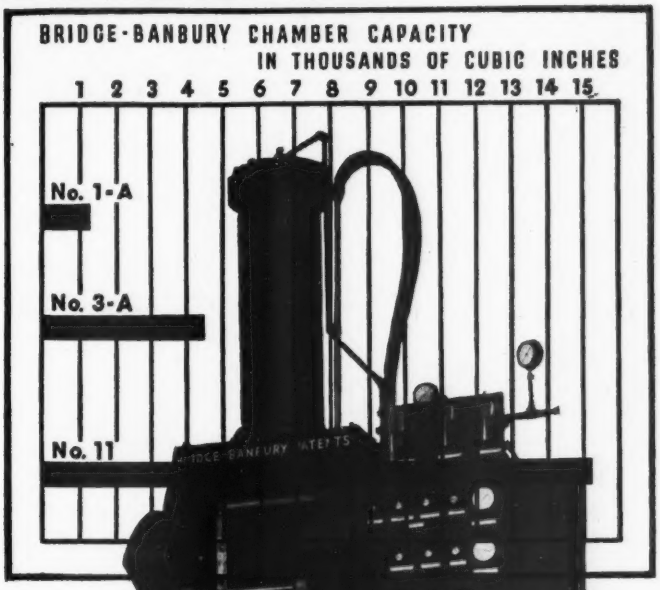

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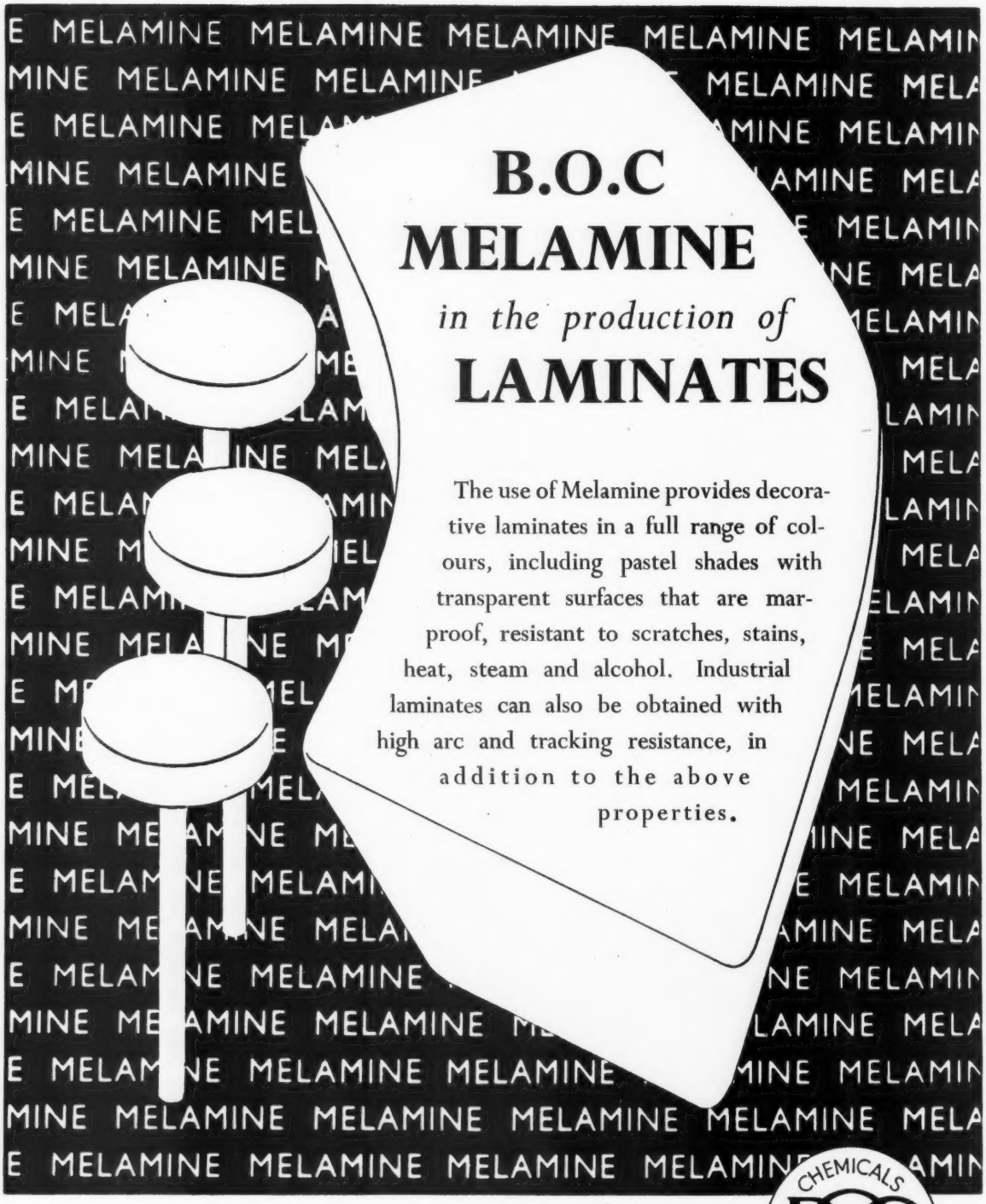
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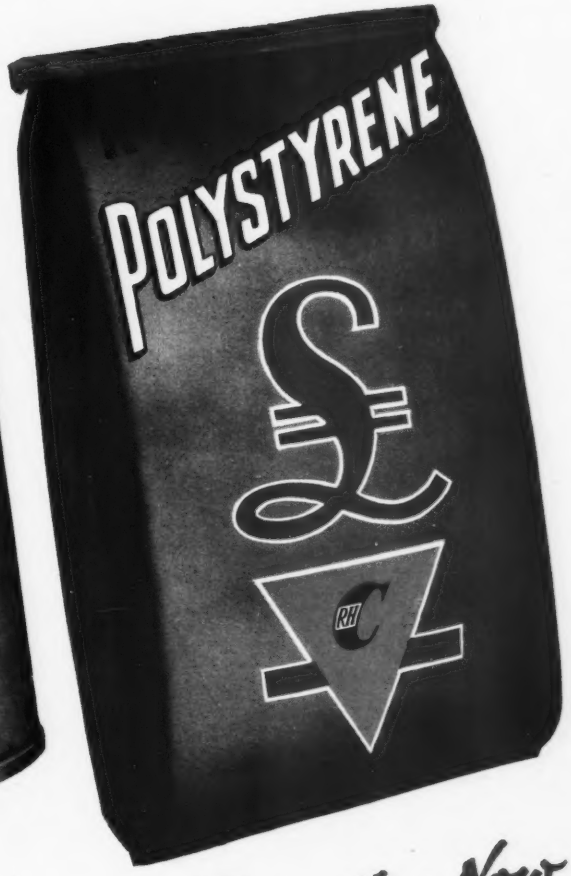

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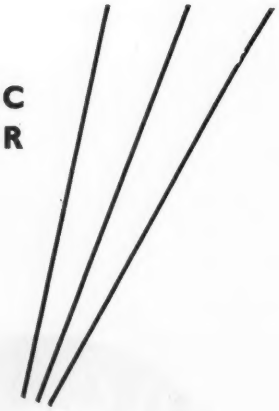

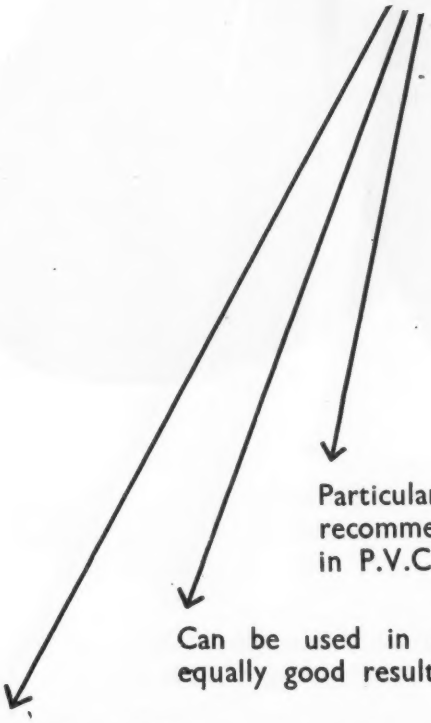

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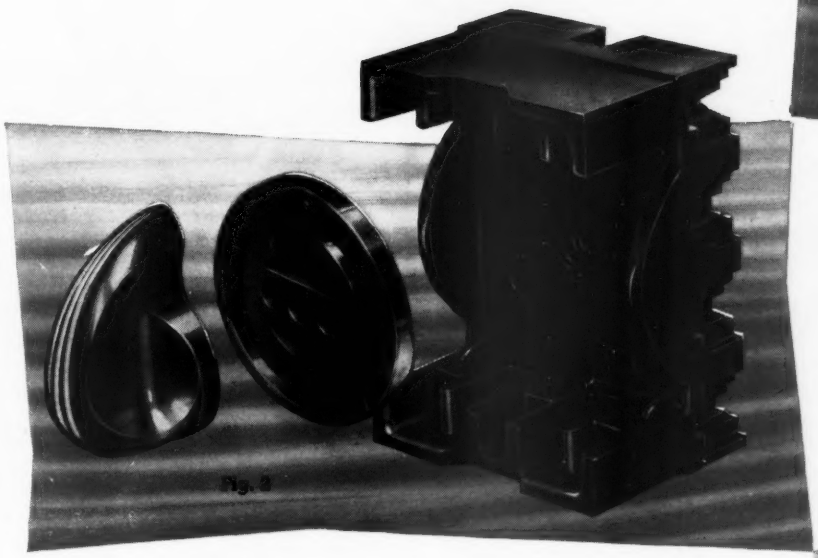

Fig. 2

25 Years of continuous service

TWENTY years ago, Insulators Limited commenced moulding for Arrow Electric Switches Ltd. The production of large quantities of component parts for Switch Gear called for precision, accuracy and the use of correct plastic materials.

Illustrated in Fig. 1 is a Through Cord Switch which has been produced continuously since our first association. Fig. 2 shows fine examples of mouldings for Base and Cam incorporated in a slow make and break Switch which called for extensive skill in tool making design.

Fig. 3 also illustrates an example of slow make and break switch with modern styled control knob requiring sound moulding technique to ensure firm fit on the spindle.

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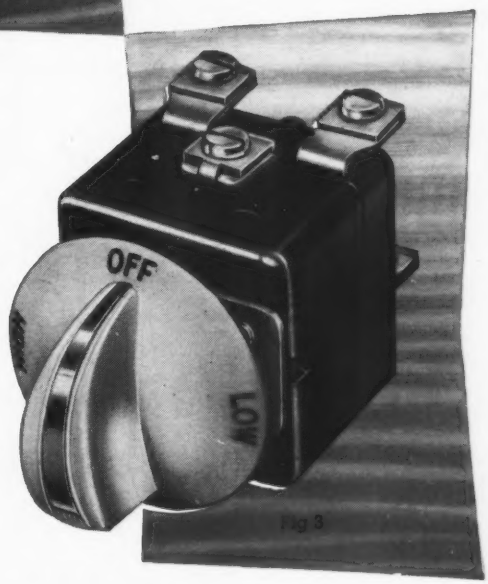

Fig. 3

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e.a.p

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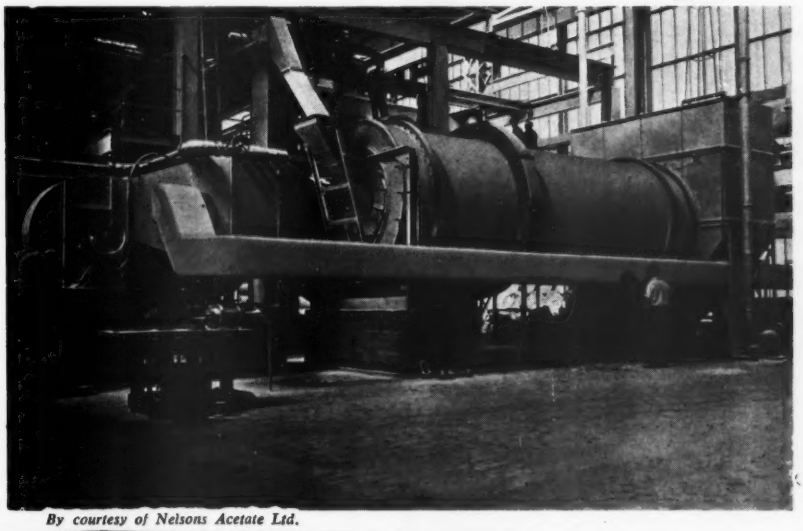

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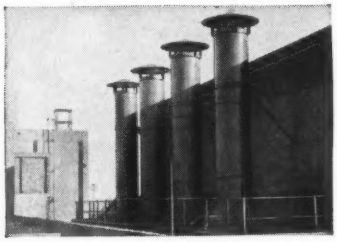

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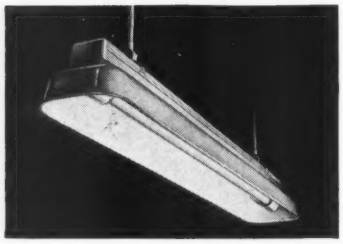

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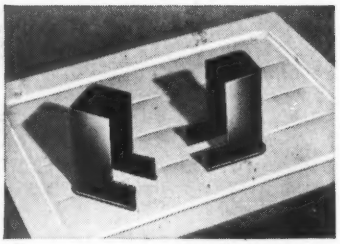

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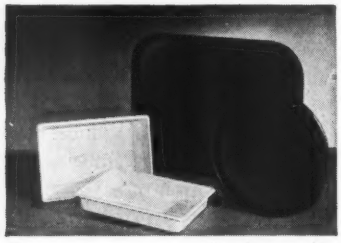

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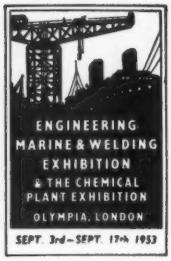

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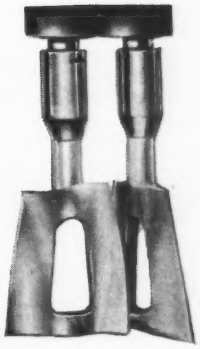

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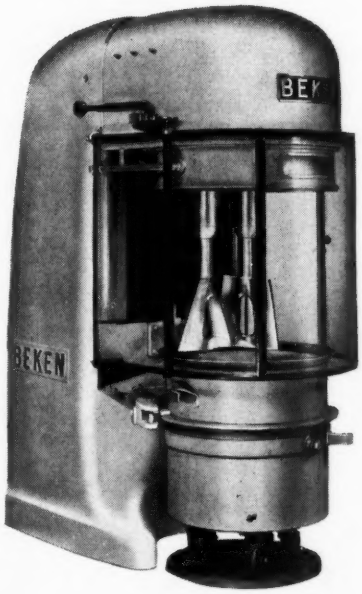

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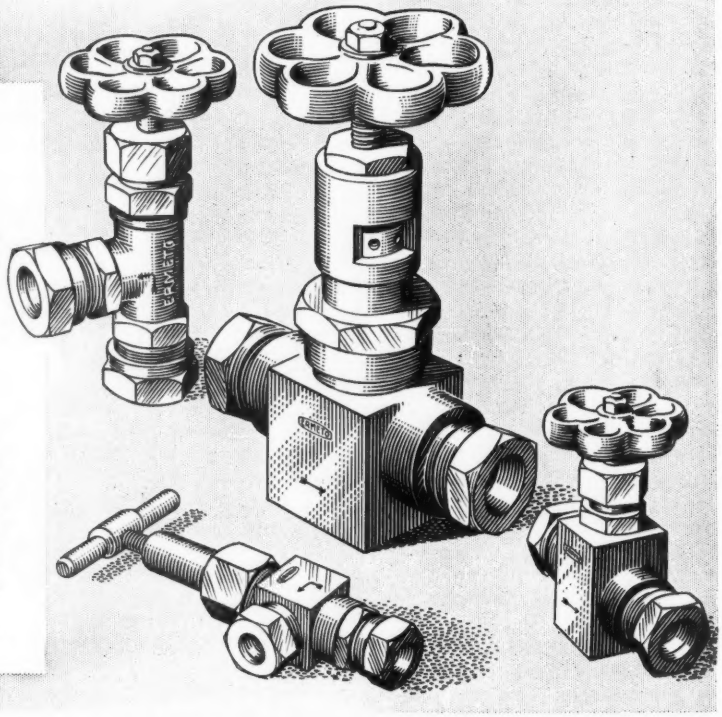

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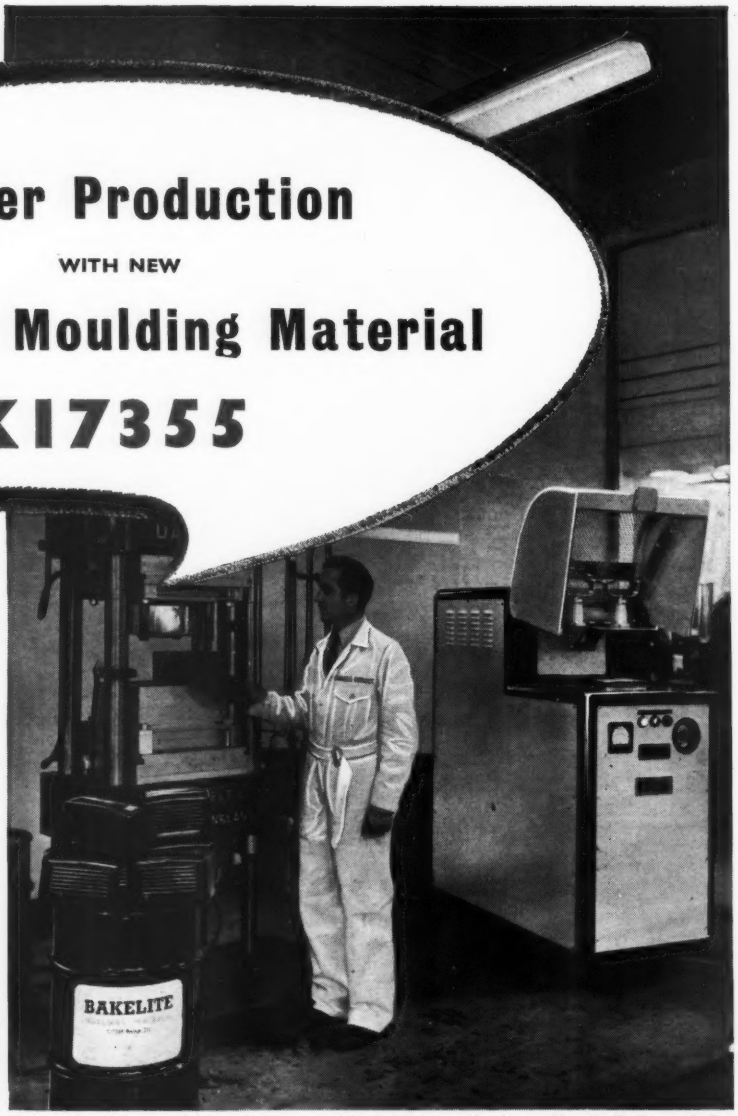

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One of the bays of polishing barrels, at the Gidea Park, Essex, factory of Loerinoid Products Ltd.

12" model of the new Vent-Axia 'Reversible' with reversing switch giving a choice of five speeds in either direction of air flow.

eighteen year test for moulded plastics

Eighteen years ago we made the first moulded plastics components for the Vent-Axia ventilating unit. All the thousands of units sold since that date, including the new 'Reversible' range, have been housed in moulded plastics of our manufacture. Moulded, too, is the all important air impeller, doing its long hours of duty at speeds up to 2,000 revolutions per minute. The louvre mouldings, made from high grade phenolic moulding material without any added finish, are exposed to all kinds of weather all the year round. The Vent-Axia story provides conclusive proof of the efficiency and economy of moulded plastics made by the National Plastics Companies.

BRITISH MOULDED PLASTICS LTD
WALTHAMSTOW AVENUE · LONDON E4
LARkswood 2323

MOULDED PRODUCTS LTD
CHESTER ROAD · TYBURN · BIRMINGHAM 24
Erdington 2201

Exploded view of the Vent-Axia 9" 'Reversible' showing the various moulded plastic parts and the patented screw ring fixing method giving even pressure on the glass and a watertight joint.

BM182

Plastics

VOL. XVIII. No. 193 AUGUST, 1953

EDITORIALS

Problem of Scrap

A RECENT visit to a well-known company of scrap-grinders (and there are now a number which give an excellent and necessary service to the industry) has made us ponder on the strange fact that thermoplastic scrap has never been very seriously discussed as a technical problem in itself. Yet it is one that concerns the moulder very closely and deeply. There is very rarely, we suppose, an average weight of scrap (i.e., gates, sprues, rejects, etc.) in any works, but since it may reach a weight higher than that of the moulding it is an obviously important factor in costing.

The general literature on plastics states that thermoplastics can be re-processed and while no doubt those not in the industry take this to mean indefinitely, yet the moulder has found through experience that there is some degradation and that there is a limit to re-cycling. At what stage degradation becomes serious from a works point of view for any given material (and each differs from another in this respect), is unknown and the technical literature is devoid of advice to the moulder. As a result the action of moulders varies greatly. For all jobs or for special jobs, only virgin material may be used and the scrap sold. The moulder may regrind the whole or part of the scrap, incorporating it into virgin material. He may keep all scrap separate, regrind and remould it without mixture with virgin material. No doubt some moulders buy scrap only and use it alone.

The first action, which is probably rare, clearly frees the moulder from worry regarding the quality of scrap, although his costs rise proportionately. If he possesses his own regrinding and mixing plant he has the work of segregating cleanly and transporting the types carefully in specially marked bins by workers trained in the knowledge that scrap should be treated as carefully as virgin material. That, shortly, is the job of many moulders and up to this point has no clear bearing on whether degradation has occurred or not.

We now come to the question: at what point is the extent of degradation of any thermoplastic really sufficient to worry about? Frankly we do not know and the literature does not help much. Very broadly speaking change during moulding is due to volatility of plasticizer by heat which leads to hardening, and also is due to de-polymerization or other breakdown which may result in lower molecular weight. Thus, theoretically, at any rate, the logical inference is that hardening or brittleness must eventually take place and that some strength, mechanical and electrical, is lost.

Some technical information on one polymer is contained in the excellent and very comprehensive book "Styrene" by Boundy and Boyer, pp. 487-8 (published by Reinhold Publishing Corporation). The information is on occasion slightly confusing, since while the authors indicate that the temperature of fabrication of polystyrene may be as high as 650° F. (340° C.) and at this temperature some molecular breakdown and loss of volatile constituents take place, they also state the polystyrene may be reprocessed again and again before degradation becomes so severe as to give brittle materials. On the other hand they publish a table of experiments carried out by Dow Chemical Co. which shows that molecular weight, tensile strength and impact strength decrease with regrinding and re-moulding a test-piece moulded from virgin material. "Weld strength," however, improves.

The decreases in the above case (14% decrease in molecular weight, 1% decrease in tensile strength and 11% decrease in impact strength) may be negligible. But if the action of utilizing scrap from already degraded material is pursued, there is no information at what point the process becomes, to say the least, unwise.

Thus to take a simple example of what no doubt approaches frequent practice. Let us presume a hypothetical case: that a moulding weight to scrap weight is 60 to 40, and that the scrap from the moulding is reground and mixed with virgin material in the above proportion and remoulded. The scrap from this second moulding is then treated again with virgin in the same proportion for a number of cycles. Regarding this as a purely mathematical exercise (i.e. disregarding complete losses that occur) we find that on such a third cycle the moulding contains 60% by weight of once moulded material, 24% of twice moulded material and 16% of thrice moulded material. A fourth cycle would produce a moulding containing 60% of once moulded material, 24% of twice moulded, 9.6% of thrice moulded and 6.4% of material moulded four times.

There is evidence that the process is pursued still farther on occasion, so that some scientific and technical analysis and clarification is necessary for guidance in manufacture. One might for example get a clear cut reply that it is better to remould all once-moulded scrap without admixture of any virgin material rather than to pursue the above re-cycling. On the other hand it may be that the actual rate of degradation diminishes rapidly with re-cycling.

It is highly probable that advances in the basic design of injection machines will prove of greatest help. Preplasticizing units and faster cycling if efficient, should reduce local overheating or, again, production of internal heat (e.g. by back pressure) rather than by surface heating, may improve conditions.

Until such time, the moulder, with more technical information regarding progressive degradation, would know at least within broad limits, the path he should tread.

The Case for Lower Imports

MR. AUSTEN ALBU, M.P., gave an interesting broadcast under the above title in the Home Service on July 7. His main theme was the urgent need for reducing our imports especially from "dollar" countries. This obviously means growing more food but he stressed even more the technological means of attaining a better balance in our expenditure. He has certainly been adequately primed on this broad subject and it is pleasing to know that his words have such a wide circle of listeners outside Parliament and no doubt within it. The scientific and technical journals have for more than 25 years given their emphatic views on the importance of the technical developments we see at long last growing slowly in this country.

Mr. Albu made reference to the need of saving timber by increasing the scale of production of hard board made

from mill-waste or forest thinnings and synthetic resin bonding and of the need for saving cotton and the production of the semi-synthetic rayon from wood-pulp which is only one-tenth of the cost of the cloth made from it. It is, of course, in this latter field that the greatest advances will be made so far as quantity production is concerned. Not only are the newer and stronger rayons expanding at the expense of cotton, but inroads into the field of woollen goods widen with the advent of the newer fibres such as Ardil made from the protein matter in ground nuts after the oil has been extracted, and the purely synthetic fibres Terylene and nylon.

The broadcaster commented also on growth of the true refining of petroleum in this country which not only saves dollars but is the direct cause of a steadily growing new chemical industry in which the plastics industry is directly involved and upon which its greater growth will doubtless depend.

Much, too, will depend on the manner in which we propose to deal with coal, or rather, because of international policy, the manner in which we are forced to deal with it. For with petroleum and coal as raw materials for chemical, plastics and synthetic rubber production we would see the possibilities of really great expansion and a continued diminution in dollar imports.

MOULDING POWDER AND SHOT

More Metal on Plastics

The subject of metallizing plastics reminds me that while at the British Industries Fair at Castle Bromwich I visited the stand of Ceramic Platers, Ltd., of Coventry, who in addition to the work obviously implied in their name do much deposition of metals on plastics. What impressed me greatly was the wide variety of colours that can be obtained by control of the deposition conditions or by subsequent chemical treatment. One of the most pleasing of metallic effects is that shown below on the ceramic bottle-shaped lamp-stand. It is extremely difficult to describe and the nearest I can get to it is a pearl coloured effect with a delicate rainbow irridescence coupled with an apparent metal-crystalline structure. Anyway it is very beautiful. The directors who are obviously metallurgical chemists of a high order told me that there was no difficulty in obtaining the same effects on mouldings of plastic materials.

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High Quality Design

Last month I reproduced some photographs of the French trend in decorating radio cabinets with artistic frets or embellishments of frets and cabinets with metallized plastic mouldings and commented on the high quality of design of the basic theme. A reader has requested a peep at the plastic moulding without the deposited metallic film. I have now obtained a sample of the moulding itself and reproduce it below. The quality of the design and the great care in making the mould itself is apparent.

The Vietum Process

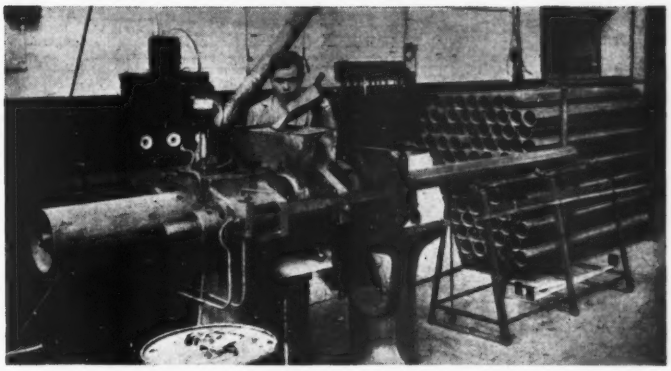
A recent letter in a motorcycling journal suggests that the damage to the finish of motorcycle parts by careless use of petrol pump nozzles can be avoided by sheathing the nozzles with p.v.c. This excellent suggestion reminds me that another method of sheathing and providing a non-rusting, shock-resistant, dielectric or attractive surface to metal and other structures has now been added to the dipping and spraying processes. It was shown at the stand of Lacrinoid Products, Ltd., at the recent British Plastics Exhibition. The new Vietum process, in many ways complementary to the older methods, is perhaps more limited in application so far as the shape of object to be covered is concerned, but is wider in scope in the sense that covering can be made with soft or hard p.v.c. In its own field it is probably the simplest. The process is based on the use of extruded p.v.c. tube produced in such a physical state that on heating, considerable shrinkage (at least 10%) takes place. On fitting such a tube quite loosely over a metal rod, for example, and heating the whole in an oven for a few minutes, shrinkage is such that the plastic covering is permanently "fixed" to the rod. Curved, irregular and carved shapes, e.g., plier, hammer and perambulator handles can thus be covered still retaining the original distinctive forms. I carried out the simplest of experiments in this office by using two overlapping Vietum tubes to cover a pencil-end and heating in front of an electric fire. Short of lifting or cutting with a pen-knife neither of the tubes is removable.

DOGSBODDY.

Left: Irridescent effect by metallization. Above: French moulding prior to metallization for radio cabinets. Right: Simple example of Vietum process of shrunk-on p.v.c. tubing.

18 Years of Extruded "Phenolics"

In June, 1937, we visited the works of Gestetner Ltd. to examine the new plant for extruding "phenolic" tubing (see right). In June, 1953, we made a second visit "to report progress."

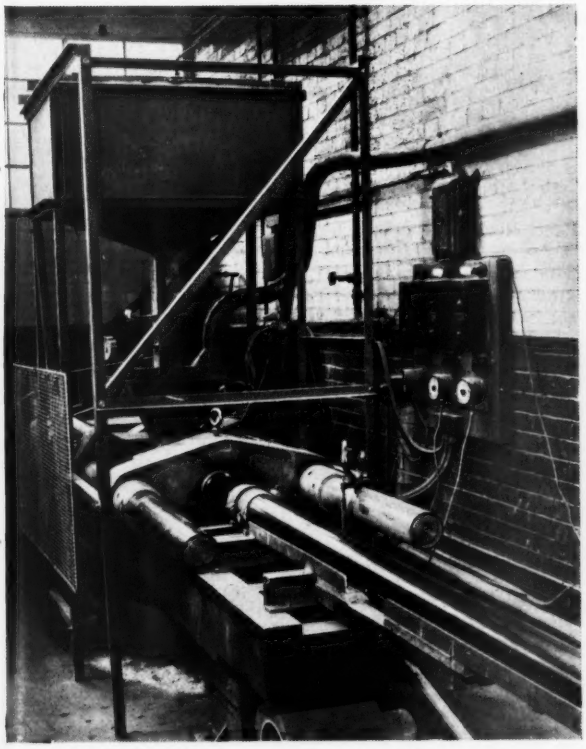


THE extrusion of thermosetting resins is about as old as the extrusion of thermoplastic resins, yet its history is vastly different. While the latter promises to expand into one of the most important sections of plastics technology the extrusion of phenolic resins and of urea resins has remained almost static, a condition which no doubt is a direct reflection of the different chemical and physical characteristics of the thermosetting and thermoplastic groups.

There are thus very few references in the technical literature to this other type of extrusion; indeed, we believe the only technical report on its commercial development in this country is contained in the June, 1937, issue of this journal; the description published in "Extrusion of Plastics, Rubber and Metals," by Simonds, Weith and Schack (Reinhold Publishing Corp.), 1952, appears to have been taken from our own report, which described the production of tubing by Gestetner, Ltd., the well-known makers of duplicating machines of London, N.17. Since the above mentioned book contains no reference to such work in the U.S.A. (although it notes the possibility of the extrusion of thermosetting resins by the Chrysler Company, Lester Engineering Co. and Monroe Auto Equipment Co.), nor in Germany where the process and the first machines were suggested and made, it seems that the methods and applications are confined to this country. There are two companies only that make such extrusions: Gestetner Ltd., who produce one size of tubing for cylinders for their machines and British Resin Products, Ltd., who make a wider variety of products, roller-curtain "rods," towel rollers, printing rolls, etc., and who also supply Gestetner, Ltd., with the special phenolic resins for the extrusions.

In spite of the limited application, the past 18 years has proved in no uncertain manner the value of the process to Gestetner, Ltd.; we have the remarkable situation that production has continued almost unceasingly during the whole period without any important change either in type of plant or in type of phenolic moulding material.

It was in June, 1937, that we were given the opportunity of examining and describing the then new technique through the kind offices of Mr. A. de Waele, F.R.I.C., F.Inst.P., Director of Research to Gestetner Ltd. We again visited their works in June, 1953 and this second occasion reminded us that few know of the process or remembered it, or realized its place in the history of the plastics industry. This second visit also gives us an opportunity of reporting on the much wider adoption of plastics in this factory.

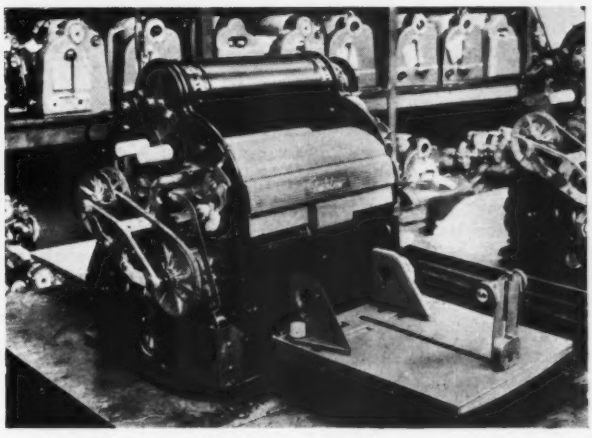


A Daniels' extruder has been added to the plant since our last visit.

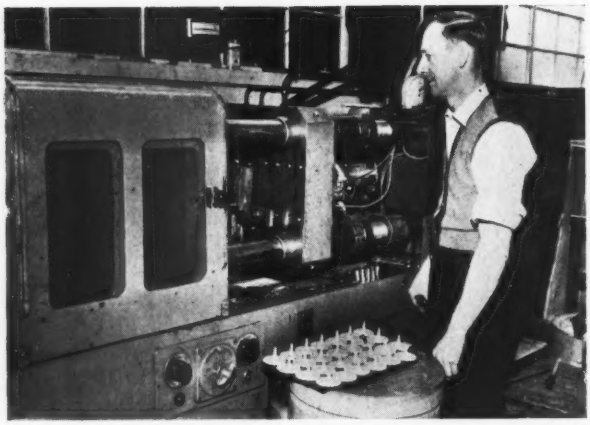
Production of Extruded Cylinders

The manufacture refers to the extrusion of the two cylinders which mechanically carry the paper in the duplicating machine.

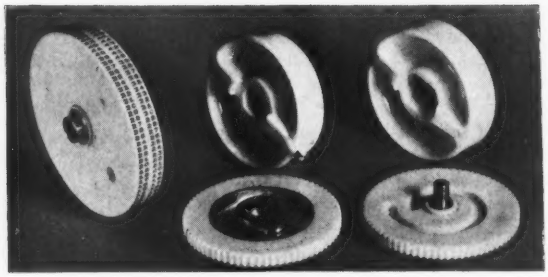
Prior to 1935 each cylinder was moulded from plaster by a simple process. It was then machined and covered by spraying

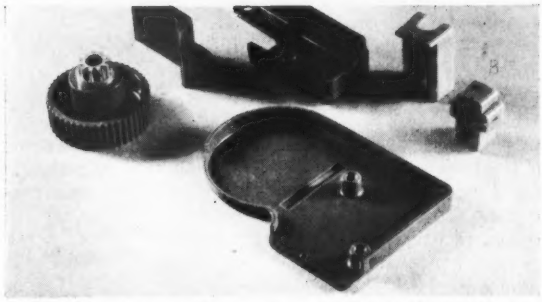


The modern Gestetner duplicating machine now incorporates many more plastic components than formerly.

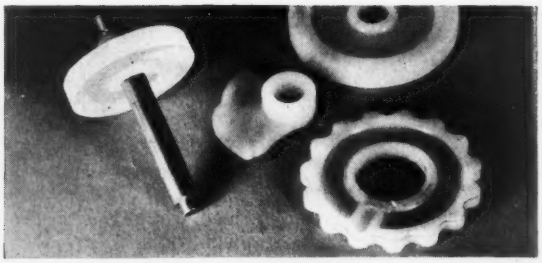


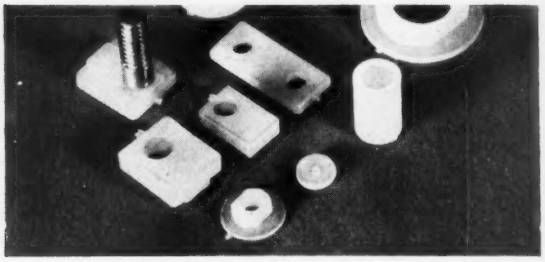
A Windsor machine producing nylon wheels.



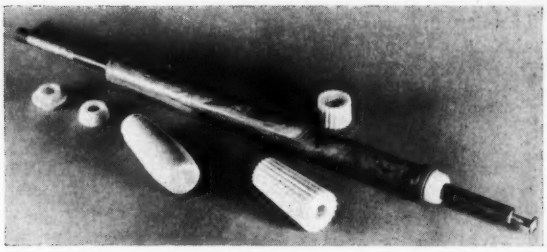


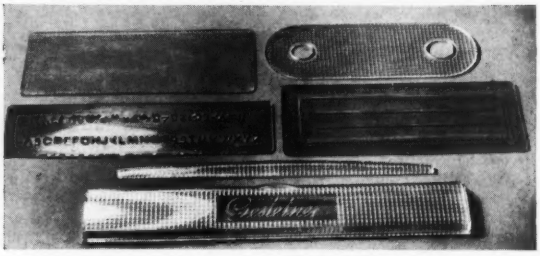
The above photographs show a number of wheels and plates of Diakon. On the right (lower) are two components in polythene.





(Above) The Gestetner machine contains some 14 nylon components.





Number-plates, holding-plates and handles are of Diakon. The spindle is of polystyrene.

with a cellulose lacquer to give a perfectly smooth surface. This type gave excellent service, but it was felt that a cylinder made from one piece would be an advantage in simplicity and rapidity of production.

It was decided therefore that the manufacture of continuously extruded cylinders from phenol-formaldehyde resin material (a Rockite moulding material was and still is used) was the obvious solution to the problem.

To the hydraulically-operated three-throw ram by Werner-Pfleiderer A.G. we saw in 1937, has now been added a Daniels machine operated by a mono-radial pump leading to a powder feeding chamber and an electrically-heated die feeding directly to a mandrel. The tube produced is 4 11/16 in. exterior diameter, the wall thickness being 7/32 in.

In order that there should be no clogging of the feeding chambers by premature curing, there must be no heating before the resin powder enters the die proper. The ram, therefore, first presses the powder into a chamber which is maintained at a low and constant temperature by cold water circulation in a surrounding jacket. The resin powder is thus maintained in a compressed form some inches before it enters the die. The die or curing chamber is an annular space some 9 in. long and is progressively heated along its length by three electric elements "stepped up" to obtain successive temperatures of 130°, 160° and 180° C. As the time of cure in this 9-in. length is about 1½ minutes, the ram works to an output of some 4 in. of tube per minute. The finished tube issues on the mandril and is sawn off in convenient lengths after close optical examination for faults such as scorching. The cylinder section is bored, the ends fitted, post-cured by stoving, and is then ground and polished to the desired finish.

Compression and Injection Moulding

The Gestetner works have contained a compression moulding shop for an equally long period. It is here that all phenolic and urea-formaldehyde pressings needed for the Gestetner machines are made. They include switch and rheostat knob, machine handles, ink-cartridges, insulating blocks, three-way connectors for the electrical models, etc. The plant comprises 50-ton and 200-ton presses by John Shaw and Sons, Ltd., and T. H. and J. Daniels, Ltd.

(*Continued on page 284*)

The British Plastics Exhibition Reviewed

In the July issue we published the first part of a report of some of the interesting features of the Exhibition. The notes and photographs which follow conclude the report. Again, the sequence of presentation follows the Exhibition Supplement published in June; machinery is dealt with first, followed by mouldings and fabrications, and concluded by materials.

"Plastics" Stand at the Exhibition.

MACHINERY AND ACCESSORIES SEEN AT THE EXHIBITION

New Tumbling Machine

Shown on the stand of Lacrinoid Products, Ltd., was an exhibition model, two-thirds normal size, of a tumbling machine specially developed to handle large mouldings. The model was fabricated in "Perspex."

Hitherto tumbling has only been suitable for small mouldings; the new machine is fitted with a special jig into which a number of large mouldings can be fitted and held in position. Wooden pegs treated with Lacrinoid polishing cream number 10 are employed. The machine offers an economic finishing technique for large articles.

(Lacrinoid Products, Ltd., Gidea Park Works, Gidea Park, Essex.)

Model of tumbling machine, two-thirds full size, fabricated in Perspex for exhibition purposes.

Combined Roller and Conveyor Take-off Units for Extruders

The Peco portable combined roller and conveyor has been designed to handle almost any type of plastic extrusion. The main pedestal and drive housing is mounted on four castors for ease of movement. The conveyor is a completely self-contained unit, except for the driving power which is provided from the main pedestal. A water tank is situated in the central drive house to cool the belt. The belt, which is heat, acid and water resistant, provides a carrying surface 6 in. wide by 12 ft. long.

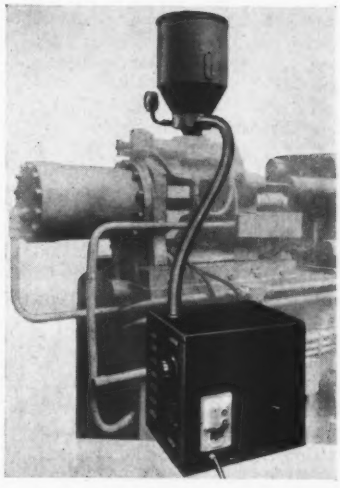
The roller unit consists of eight flanged roller spindles, four upper and four lower, mounted on a flat plate on the main pedestal. The lower spindles are chain driven direct from the motor. The upper ones are idle, each being spring loaded. The speed of the conveyor or the rollers can be controlled between 5 and 60 ft. per minute. Remote control is provided for use at the extruder controls, besides a control knob and speed indicator on the pedestal of the take-off unit.

(Projectile and Engineering Co., Ltd., Battersea, London, S.W.8.)

Material Dryer for Injection Moulding Machines

A material dryer for preheating injection moulding materials in the hopper of the machine has been introduced by Projectile and Engineering Co. for use with any of their machines. The dryer consists of two parts—a specially constructed hopper designed to subject the material to an even distribution of heated air, and a separate heater unit which can be located in any convenient position adjacent to the machine and is connected to the hopper by an insulated flexible tube. The heater has a dry type cleanable air filter, a high-pressure centrifugal fan and motor, a compact 3-kW. heater, and an electrical control panel. The heater is split into three separate 1-kW. sections, any one of which is in circuit with a variable transformer. Thus, the heat input can be varied completely from zero to 3 kW. An indicating thermometer is fitted in the air gallery around the hopper base.

(Projectile and Engineering Co., Ltd., Battersea, London, S.W.8.)



The Peco material dryer, replacing the hopper of injection moulding machines, supplies a continuous stream of hot air for pre-heating Thermoplastic material.

Temperature control unit manufactured by Projectile and Engineering Co. Ltd. and reported in the June issue of "Plastics."

Radio pre-heating

As an aid to increased production, pre-heating is now well established. The use of a radio oven ensures rapid and even heating throughout moulding powder pre-forms, and yields a thoroughly plasticized material ready for immediate moulding. Finished products are free from blisters due to steam because moisture is vaporized during the pre-heating process. Wear and tear on tools is greatly reduced and the moulding possesses a higher electrical insulation value.

The Radyne H5/A machine contains an oven which will accommodate preforms up to 11 in. x 9 in. x 3½ in. in height. A full-vision time clock, adjustable between 5 sec. and 10 min., starts as soon as the lid is closed and at the end of the selected time the lid opens automatically.

(Radio Heaters Ltd., Wokingham, Berks.)

Radio Frequency Pre-heater

A new Redifon pre-heater, RH32, has been designed to ensure quick, efficient heating combined with mechanical robustness and electrical reliability to give a long and trouble-free working life. Output is 1 kW 14 oz. of g.p. moulding powder being pre-heated per minute. A unique feature is that the heat dissipated by the oscillator valve during operation is utilized to warm the lower electrode, thus ensuring minimum heat loss in the pellets, with maximum usage of current. Other special features of this unit are the quick-action counter-balanced lid, a flush-mounted lower electrode for fast loading and ease of cleaning, and readily changeable air filter.

(Redifon, Ltd., Broomhill Road, Wandsworth, London, S.W.18.)

Heat-sealing and welding equipment

A range of hot gas welding torches for the production of rigid p.v.c. structures is manufactured by Rediweld, Ltd. This company also produces a number of machines for the packaging industry, such as heat-sealing for polythene bags, crease-bending for cellulose acetate, etc. A novel exhibit was a machine designed to open plastics film bags prior to filling.

(Rediweld, Ltd., Crompton Way, Crawley, Sussex.)

MOULDINGS AND FABRICATIONS SEEN AT THE EXHIBITION

Domestic ware

Amongst the many interesting exhibits of the Barclay Stuart stand was a thermos hot-water jug moulded in wood-filled urea powder. The article comprises four sections, each of which is moulded in a single-impression tool to a high degree of accurate finish.

(Barclay Stuart (Plastics) Ltd., 25-27 Brunswick Street, Luton, Beds.)

Refrigeration components

Polystyrene has found wide application in the construction of domestic refrigerators and British Moulded Plastics Ltd. displayed several examples of high-quality mouldings in this material. These included food trays and food containers. Polythene finds application in the manufacture of ice-cube trays.

(British Moulded Plastics Ltd., Avenue Works, Walthamstow Avenue, London, E.4.)

Polythene Baby's Bath

Following the introduction of their polythene wash bowl, E. K. Cole are now moulding a translucent coloured baby's bath. The "Plastabath" is shaped to hold an adequate quantity of water without incurring excessive weight. The dimensions are 16½ in. wide by 6 in. deep by 23½ in. long. The weight is only 3 lb. The design incorporates built-in trays for soap, brush, etc., and a moulded-in tag is provided for hanging the bath when not in use.

(E. K. Cole, Ltd., Southend-on-Sea, Essex.)

Ink filling station

An interesting feature of the stand of Insulators, Ltd., was an ink filling station for the Parker Pen Co., Ltd., moulded in phenolic powder having ink reservoirs moulded from acrylic material. The design of the complete unit is well carried out and the use of plastics materials ensures an attractive-looking and long-lasting unit which advertises well the name of the Parker Company.

(Insulators, Ltd., Edmonton, London, N.18.)

Inspection covers for aircraft

Acrylic materials have for a long time found wide applications in the aircraft industry. Interesting examples were shown on the stand of Kent Mouldings. These were transparent inspection covers, injection moulded for the Vickers-Armstrong Co., Ltd.

(Kent Mouldings, Footscray, Kent.)

Filing cabinet accessory

In the normal filing cabinet, a plate, frequently made from brass, is fixed to the front of each drawer to act as a holder for a card to indicate the drawer's contents. A new moulding in polystyrene is designed to avoid the necessity for such a plate. A clear plate in polystyrene, containing holes through which the handle can be fixed, is moulded by J. F. Kenure Ltd. When the handle is bolted into place the frame is also securely fixed.

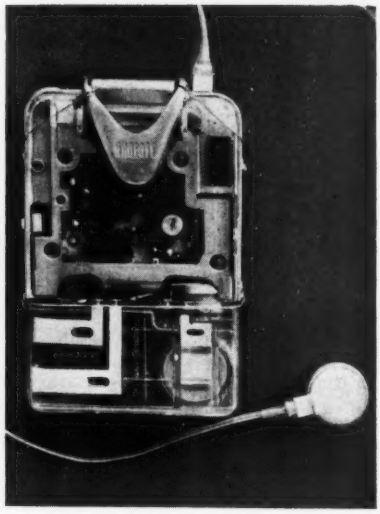
The job is moulded in a two-cavity tool on a 4-oz. Reed-Prentice machine.

(J. F. Kenure, Ltd., Faggs Lane, Feltham, Middx.)

Hearing aid

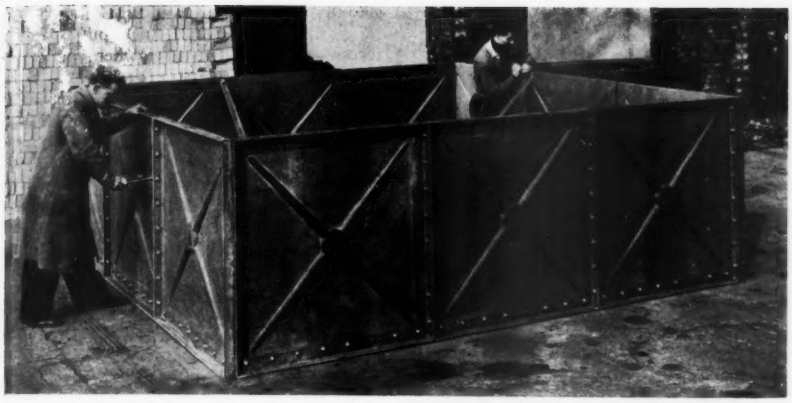
Manufactured for R. H. Dent Ltd., a series of mouldings were displayed. One, the chassis, having an area of roughly 2 in. x 1 in., has 40 holes moulded in situ. The tolerances of these mouldings are plus or minus 2 thou. of an inch. Employing a printed circuit, the complete unit represents a high degree of technical achievement.

(Lacrinoid Products Ltd., Gidea Park Works, Gidea Park, Essex.)



Hearing aid shown with transparent cover to demonstrate the intricate moulded components. Manufactured by Lacrinoid Products, Ltd.

Lacrinoid p.v.c. bottle for lighter fuel.



(Left) Static water tank manufactured by Microcell, Ltd. Moulded in 4 ft. sq. panels from polyester resin-bonded glass fibre material. The tank will hold 3,600 gallons, and apart from resistance to chemical attack and corrosion, light weight is an important advantage, especially in the case of temporary tanks which have to be transported.

Petrol resistant bottles

The now familiar technique of blowing bottles from an extrusion, normally carried out in polythene, has been adapted for use with some semi-rigid p.v.c. material. These bottles have excellent resistance to the hydrocarbons and are used now as containers for lighter fuel.

(Lacrinoid Products Ltd., Gidea Park, Essex.)

Work trays

Moulded for Hyvac Ltd. on a single-impression tool, are work trays used in the assembly of midget valves and lamps. The design of the trays incorporate the special features required by the customer and Bakelite moulding materials are employed to execute the job.

(Litholite Insulators and St. Albans Mouldings Ltd., Sandown Road, Watford, Herts.)

Terrazzo Flooring Strips

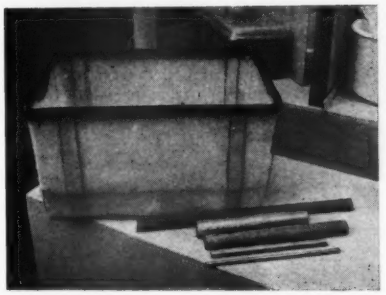
A field in which rigid p.v.c. extrusions have made a contribution to the building industry is the provision of coloured separating strips for terrazzo flooring. Besides being decorative, they prevent the cracking of the floor due to thermal expansion. When laid, the strips lie flush with the surface and various designs can be made by bending them to shapes.

(Melwood Thermoplastics, Ltd., Harpenden, Herts.)

Tool Handles

The toughness and excellent appearance of cellulose acetate butyrate make this material an obvious choice for the manufacture of handles, particularly for screwdrivers. Melwood Thermoplastics, Ltd., produce extruded rod in transparent amber cellulose acetate butyrate suitable for machining to shape for tool handles.

(Melwood Thermoplastics, Ltd., Harpenden, Herts.)

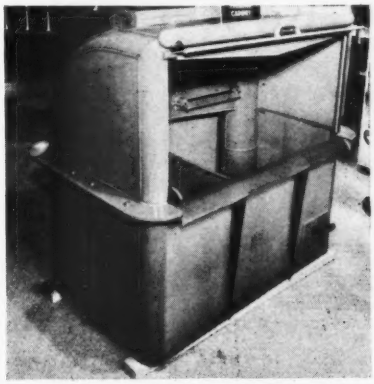


Accumulator covers in glass fabric bonded with polyester resin. Designed for the Percival Aircraft Co., Ltd., and manufactured by Thermoplastics, Ltd., Dunstable, Beds.

Hypodermic syringes

As a moulding material nylon is making great strides, and an unusual application was shown on the stand of Punfield and Barstow (Mouldings), Ltd. This was a hypodermic syringe, injection moulded in nylon. The plunger is designed to be fitted with a removable bush and the barrel is graduated. By using nylon as the moulding material, an article is produced which has great resistance to shrinkage, can be sterilized safely, and which has a long life.

(Punfield and Barstow (Mouldings), Ltd., Westmoreland Road, London, N.W.9.)



(Above) Pickling cabinet fabricated from rigid p.v.c. by the welded process. Manufactured by Rediweld, Ltd., Crompton Way, Crawley, Sussex, and described on page 240 of the July issue of "Plastics."

(Left) Experimental fish box fabricated for the Ministry of Food by Saro Laminated Wood Products, Ltd. Glass fabric bonded with Cellobond polyester resins is used as the fabricating medium. Advantages claimed include strength and excellent cleansing properties, thus ensuring a long working life for such boxes.

Laboratory apparatus

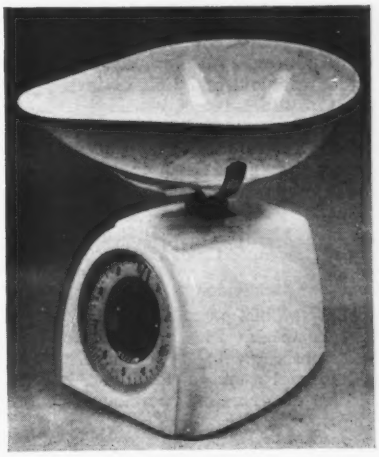
Utilizing unplasticized p.v.c., and employing the welding technique, Rediweld, Ltd., showed a variety of fabrications for laboratory purposes. These included test-tube racks, stirrers and pipette holders. P.v.c. finds ready applications for units of this type by virtue of its chemical resistance and strength.

(Rediweld, Ltd., 15 Crompton Way, Crawley, Sussex.)

New domestic balance

A new scale, manufactured by Geo. Salter and Co., Ltd., is fitted with a scoop moulded in cream polystyrene by Streetley Manufacturing Co., Ltd. The scoop is injection moulded and was displayed at the Exhibition. The case for the machine is also in polystyrene and the complete unit has a most attractive appearance.

(Streetly Manufacturing Co., Ltd., Streetly, Sutton Coldfield, Birmingham.)



Salter scale.

Fabricated containers

On the stand of Utilex, Ltd., were shown examples of fabrications from cellulose acetate, many of which embodied new shapes and designs. These examples showed once again that cellulose acetate has a great place in the packaging field by virtue of its toughness conbined with a high degree of transparency, thus increasing sales appeal.

(Utilex, Ltd., Mill Street, Kingston-on-Thames, Surrey.)

RAW MATERIALS AND THEIR APPLICATIONS SEEN AT THE EXHIBITION

Glass cloth laminates

Ashdowns Ltd. exhibited four main types of laminates, but for other applications a variety of similar products can be produced using glass cloth of a different construction. The " R " grade is used for electrical components by blanking the laminate into any required shape or form. The assembly is then vacuum impregnated. The " B " grade is of a " Fireproofed " type which does not support combustion and finds its application, for example, in the lining of aircraft—freight and other compartments. The " H " and " SP " grades represent two entirely new developments in the field of glass fibre-polyester laminates and other glass fibre-reinforced products. The " H "-type laminates or other shapes, using a new polyester resins and glass cloth, withstand temperatures of 225° C. for short periods and for prolonged periods temperatures between 175° C. and 225° C. It is anticipated that in the electrical industry this new type will find a ready application. The " SP " grade glass cloth laminate is claimed to be superior in its electrical properties to any at present on the market without additional vacuum impregnation and, in addition, its heat resistance for short periods is also better than those bonded with phenolic or melamine resins. A cheaper general purpose glass fibre-reinforced laminate is being marketed by Ashdowns Ltd., using unwoven glass fibres as the filler, and this type of laminate is obtainable semi-translucent or opaque in various shades.

(Ashdowns Ltd., St. Helens, Lancashire.)

Plastics in the garden

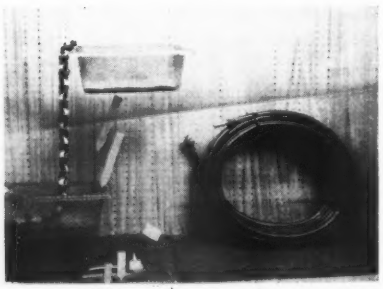
An interesting little display on the BX Plastics stand showed various uses of their material in horticulture. These include celluloid and Cobex vinyl copolymer for garden labels, extruded p.v.c. for garden hose, extruded p.v.c. strips for tree ties and a novel use for the expanded mesh plastics sheeting made in co-operation with Expanded Metal Co. Ltd., for flower pot boxes.

(BX Plastics Ltd., Higham Station Avenue, Chingford, London, E.4.)

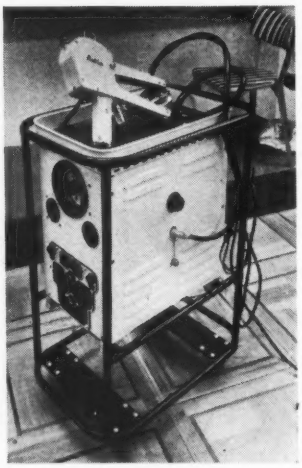
P.v.c. for packaging

Thin flexible p.v.c. sheeting is successfully competing with polythene for many protective packaging applications. On the BX Plastics stand a Redifon J.P.9 tong welder incorporating portable electrodes with trigger control was seen in operation, making high finish welded seams to seal p.v.c. film packages.

(BX Plastics Ltd., Higham Station Avenue, Chingford, London, E.4.)



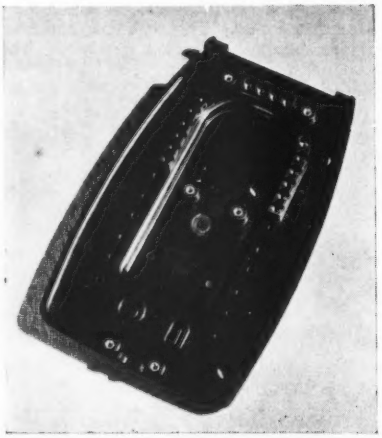
Plastics in the garden (BX Plastics Ltd.)



Redifon J.P.9 portable Tong Welder on the BX Plastics Ltd. stand.

Improved Impact Polystyrene

A new material in the Bakelite range is the improved impact polystyrene. This is a rubber modified material with greatly improved impact figures. The latest telephone manufactured by Ericsson Telephones, Ltd., designed for use as a desk set or for wall mounting, makes use of a base moulded in the new material. The main body and the hand piece of the telephone are moulded in a standard grade of Bakelite phenolic material.



Polystyrene telephone base

(Bakelite, Ltd., Grosvenor Gardens, London, S.W.1.)

Plasticizers

Improved processing techniques have led to the production of phthalate plasticizers which are of excellent colour and colour stability and which are virtually odourless. In particular, di-butoxyethyl phthalate is recommended for polymer emulsions—it has good compatibility and is readily emulsified. The company are especially well-known for the quality of the tri-tolyl phosphate which they manufacture and the sample on display, representative of current production, was of excellent colour and was virtually free from odour. High-quality adipates and sebacates were also on show together with di-benzyl ether, a plasticizer for butadiene acrylonitrile rubbers.

(A. Boake, Roberts and Co. (Manufacturing), Ltd., Carpenters Road, London, E.15.)

Stabilizers for p.v.c.

In addition to the well-known range of solid stabilizers and stabilizer dispersions, samples of three new products were on display:

Lead salicylate (Pb 43%): a light stabilizer of particular interest to compounders of p.v.c. floor coverings. It imparts some heat stability but is often used in conjunction with other heat stabilizers. It is suitable for use in products plasticized with phosphate esters, such as tri-tolyl phosphate.

Lead octyl maleate (Pb 15%) in D.E.H.P. and glycerol 1, 2 iso-propylidene ether laurate: these two materials are recently developed stabilizers which are available at present in experimental quantities only. Preliminary tests have given encouraging results and further trials are proceeding. They are suggested for trial in the production of clear films with good heat and light stability. They are covered by provisional patents held by Abrac.

(A. Boake, Roberts and Co. (Manufacturing), Ltd., Carpenters Road, London, E.15).

P.v.c. rainwear

One of the displays drawing considerable attention during the Exhibition was on the British Geon stand where fashion models showed the latest styles in the use of p.v.c. sheeting for rainwear. In addition to garments made up by welding and stitching from calendered p.v.c. sheeting, foul-weather garments in p.v.c.-impregnated material were seen.

(British Geon Ltd., St. James's Square, London, S.W.1.)

Resins for rubber

A new range of resins based on cashew nut shell liquid has been developed for use with both natural and synthetic rubbers as hardness reinforcement and processing aids. The use of these resins permits the preparation of a variety of products ranging from soft vulcanisates to hard ebonite-like materials and they are expected to help in solving a number of problems in the rubber industry. Because of their thermoplastic nature in the uncured state, these resins function as processing aids during compounding. A series of booklets issued by British Resin Products, Ltd., gives details of the use of 83032 resins with acrylonitrile/butadiene copolymers and with natural rubber. Actual applications of these resinated rubbers show a blown ebonite material for use as a structural filling material and a nitrile rubber base adhesive. A modified

styrene for use in shoe soling compounds enables cold-milling techniques to be employed.

(British Resin Products, Ltd., 21 St. James's Square, W.1.)

P.v.c. compounds for extrusion, injection and calendering

Polyvinyl chloride compounds in different degrees of hardness according to the purpose for which they are required are available for each of the three processes. Special types include Arctic grades for low temperature flexibility, electrical grades for extrusion and for outer sheathing and a special high-clarity crystal grade. Other p.v.c. compounds contain fillers for low cost.

(East Anglia Plastics, Ltd., 52 Brook Street, London, W.1.)

Polystyrene carton clips

2.C.L. high molecular-weight Erinoid polystyrene with somewhat tougher properties than general-purpose material has been used by Illingworths (Plastics), Ltd., for moulding clips to seal wax cartons. It is obvious that considerable bending strength is required in this application. The carton manufacturers are Satona, Ltd.

(Erinoid, Ltd., Stroud, Glos.; Styrene Products, Ltd.)

Satona waxed carton with closure moulded of Erinoid 2.C.L. polystyrene.

Grinding wheel resins

The many different requirements of bonding materials for grinding wheels make it necessary to produce many types of phenolic resins for this application. A company founded by Charles Lowe, the first man to produce phenol commercially, has specialized in this field, and supplies many of the leading manufacturers of grinding wheels, abrasive discs and abrasive bands. Special resins each formulated to the individual needs of a particular problem are also supplied for the foundry, textile treatment, laminates, timber and furniture.

(Chas. Lowe (Manchester), Ltd., Reddish, Stockport, Cheshire.)

Decorative laminates

Decorplast, decorative laminates produced by Holoplast is the latest product to enter this field. The stand showed a number of different colours and designs and the type of applications—for panelling, table tops, bar counters, etc.—with which users of such laminates are already familiar. The other products of this company, namely Holoplast panelling and Corroplast roofing sheet were demonstrated and in fact used structurally on the stand.

(Holoplast, Ltd., 116 Victoria Street, London, S.W.1.)

Applications for laminates

Graphite loaded fabric and tubes. The incorporation of graphite fillers improves the bearing properties of p.f.-bonded fabric laminates. **Piston rings for air compressors.** Oil lubricating materials cannot be used with compressed oxygen because of the danger of explosive mixtures. In consequence, piston rings machined from fabric-based laminates, which require only water lubrication are used for air compressor units. **Machined paper laminated tube for Lamson tubes.** A new version of the pneumatic Lamson tubes used for inter-departmental communications in large stores and offices, incorporates a selector unit whereby one of a number of stations can be found by the same tube. The necessary contacts, spacers and index rings are fitted on to a paper laminated tube forming the main housing. A fabric base laminate is also used for the hinged cap.

(Ioco, Ltd., Glasgow.)

Anti-static flooring

Phoengard anti-static p.v.c. flooring has been developed particularly for use in operating theatres in hospitals where high temperatures and the presence of inflammable vapours provide a grave risk of explosion. This material is available in the form of plain non-slip black sheeting or tiles. Flooring of this type has now been tested at the Charing Cross Hospital for one year and has been proved completely satisfactory. The test requirements specify a direct wet test with a minimum of 100,000 ohms. Many other hospitals are now being similarly fitted with Phoengard flooring.

(Phoenix Rubber Co., Ltd., 91 Bishopsgate, London, E.C.2.)

P.v.c. for pedestrian crossings

An improved form of vinyl sheeting giving complete safety by improved non-slip properties is available in plain and embossed forms. This material is used extensively in marking zebra stripes used at pedestrian crossings.

(Phoenix Rubber Co., Ltd., 91 Bishopsgate, London, E.C.2.)

Powder coatings

Polythene is employed in the form of a powder to provide a protective coating having a wide field of applications. As examples may be mentioned the insulation of aerials for radio and service equipment, for the covering of domestic equipment, and the storage and packaging of foodstuffs.

Examples of articles coated by the Telcothene powder process include dolls, tool handles, wire mesh and interiors of metal drums.

The powder can be used to form a dip coating and can also be sprayed through a flame spray gun. In the former case the metal object to be coated can be placed in an oven; when the required temperature has been reached the article is quickly removed from the oven and immersed in a sufficient quantity of powder to ensure complete coverage of the portion to be coated. Excess powder is shaken or brushed off and then the article is replaced in the oven at a temperature of 140-160° C. until the powder fuses to a smooth coat. If this latter temperature is exceeded the powder tends to run.

Telcothene powder has a melting point of 110-120° C. and has satisfactory resistance to a wide variety of chemicals.

(Telegraph Construction and Maintenance Co., Ltd., Greenwich, London, S.E.10.)

Paper for the Plastics Industry

The Wiggins Teape Group has for a long time specialized in the production of papers to meet particular industrial requirements, and a number of new papers shown at the Exhibition will be of considerable interest to plastics manufacturers. For the fast-growing field of reinforced plastics, special papers have been produced. It is suggested that papers with 100% glass fibre or 100% asbestos fibre content may satisfactorily replace woven or non-woven fabrics for low-pressure laminations. These completely inorganic papers would find uses where heat resistance and mechanical strength are required.

Papers for high-pressure laminates consist of kraft core papers as well as pigmented surfacing papers for decorative surfaces.

Plastics also find uses in the treatment of papers such as U.F. or melamine resins wet-strength papers or thermoplastic resin-treated papers. The stand, besides showing the range of products available demonstrated a number of performance tests being carried out.

(Wiggins, Teape and Alex Pirie (Sales), Ltd., Mansell Street, London, E.1.)

Coconut shell flour for moulding powders and glues

Vavanite coconut shell flour has been suggested and is now being used as a filler for synthetic resin glues, as a filler for phenolic moulding powders and also as an extender for phenolic moulding powders. With resin adhesives, particularly phenolic adhesives, the use of coconut shell fillers is claimed to avoid cracking or crazing, to improve gap filling properties and to increase water absorption. The fact that any free formaldehyde in the resin adhesives combines with constituents in the coconut shell flour also adds to the strength of the joint.

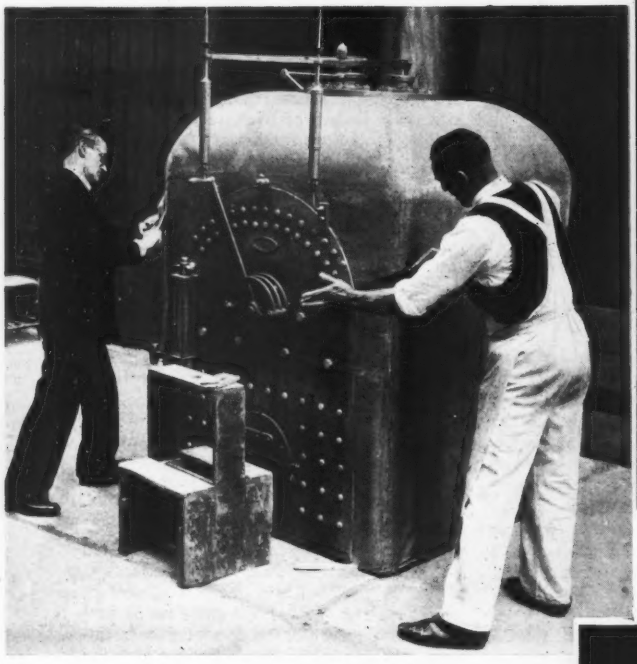
When used as a filler for phenolic moulding powders, much lower resin content powders can be produced, e.g., 30% resin content being equivalent to 45-50% resin content on conventional fillers. As an extender up to 20% of coconut shell flour can be cold dry mixed with an existing moulding powder to give a moulding material losing nothing in mechanical or electrical properties.

(J. H. Vavasseur and Co., Ltd., Ceylon House, America Square, E.C.3.)

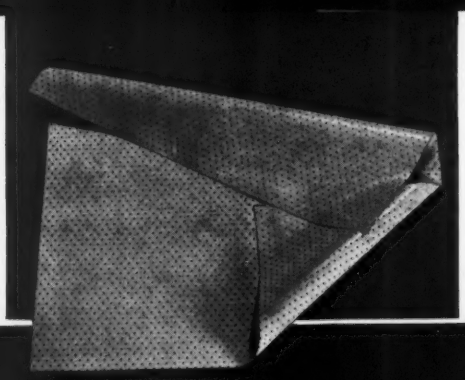
PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

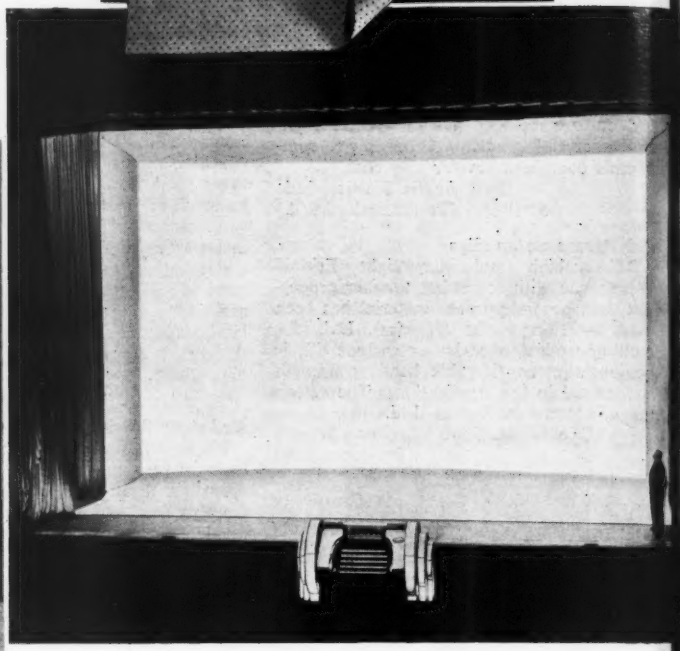
40. Cinema



(Above) Fibrenyle thermoplastic felt which can be easily shaped without heat or pressure was used by Ealing Studios for making the fire box of the full scale model locomotive.



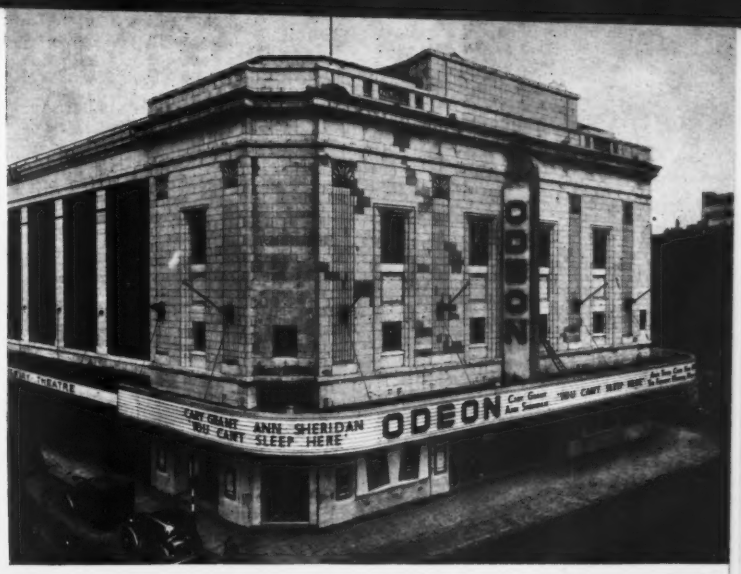
(Left) Plas sheeting us the cin screen s below.

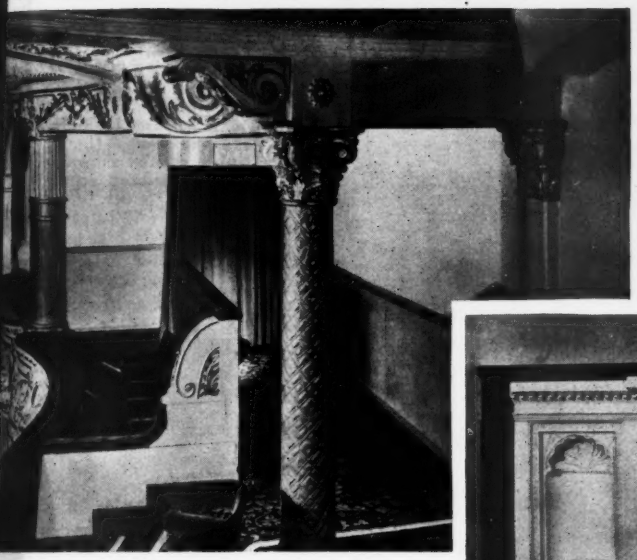


(Above) The new wide screen at the Odeon Cinema, Leicester Square, Londo is made from a perforated white p.v.c. sheeting (see inset above) supplied b Wallington, Weston and Co., Ltd. The screen was made by Stableford Screens, Lt

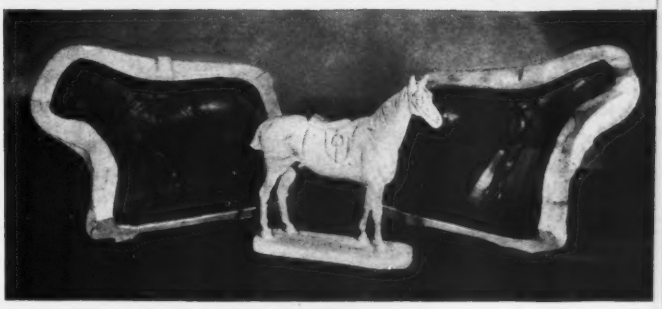
(Above and left) The ease of handling Fibrenyle felt sheeting, made by Fibrenyle, Ltd., has been used by many film studios in making film sets and props, ranging from rocks to elephants, rhinoceroses and hippopotami. The locomotive (above), star of the Ealing Studios film "Titfield Thunderbolt" has a smoke stack and fire box constructed from this material. The illustration on the left shows the smoke stack being mounted.

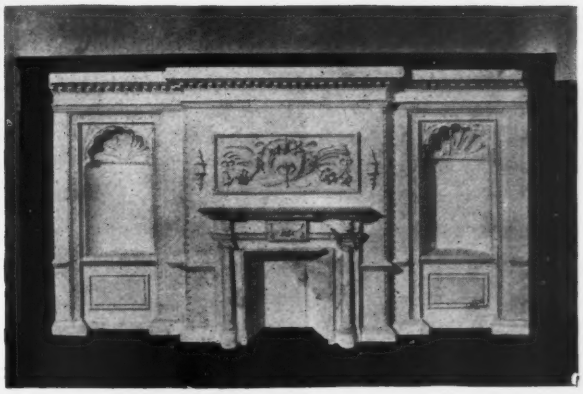
(Below) Edge-lighted illuminated "Perspex" signs used in cinemas are clear yet unobtrusive. (Right) The fascia and canopy of the Odeon Cinema, Manchester, make extensive use of "Perspex" acrylic sheeting. (Photos: I.C.I. Ltd.)



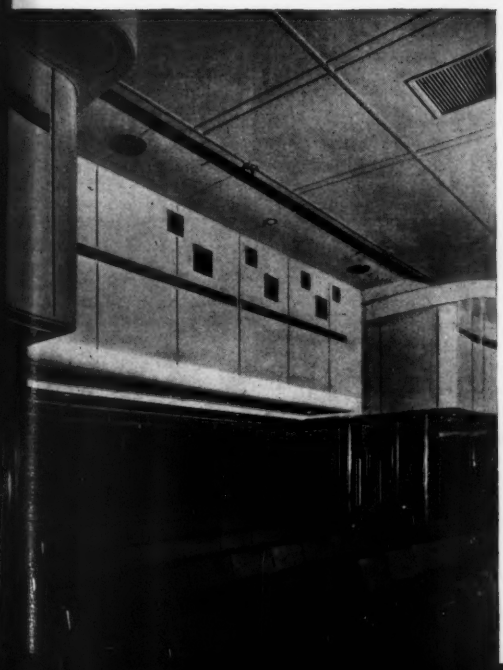


(Above) The auditorium of the Palace Theatre, Blackpool, is panelled up to dado height with Formica decorative laminates, manufactured by Thos. De La Rue and Co., Ltd.

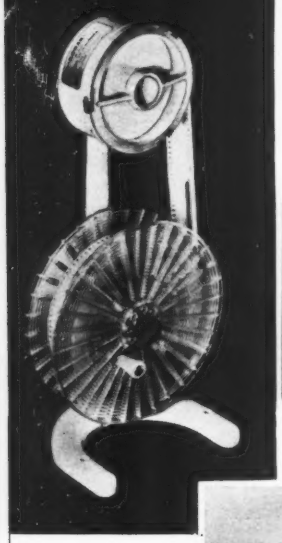




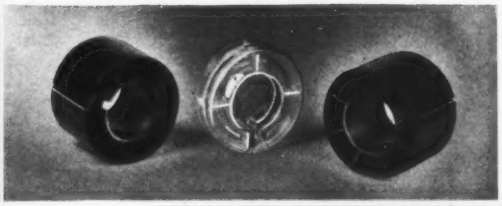
(Above and left) The moc horse for a miniature film s by Metro-Goldwyn May British Studios Ltd., w cast from Vinamold h melt plastic flexible moul The miniature film set (le by British Lion Film Studi Ltd., incorporating very fi architectural details was a cast in Vinamold, which produced by Vinyl Produc Ltd.

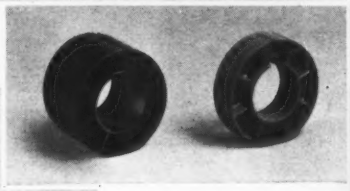


(Above and left) Holoplast structural panels and lining sheets were used for the walls and floor of the first-class cinema on R.M.S. "Queen Mary" (above). Holoplast acoustic panels were used for the ceiling. The first-class cinema on S.S. "Caronia" (left) also employs Holoplast acoustic treatment. (Photos: Holoplast, Ltd.)



(Below) Ciné-film supplied to studios by Ilford Ltd., is wound on moulded plastic cores which fit on standard 1-in. diameter spindles. Both the large cores for 35 mm. film and the smaller ones for 16 mm. film are moulded by Injection Moulders, Ltd.





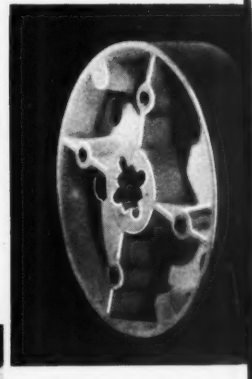
(Above and left) Foamed urea formaldehyde produced by Expanded Rubber Co., Ltd., was used by Ealing Studios for snow scenes in the film "Scott of the Antarctic." The light weight of the material is well shown in this illustration (left). ("Plastics," September, 1948, page 461).

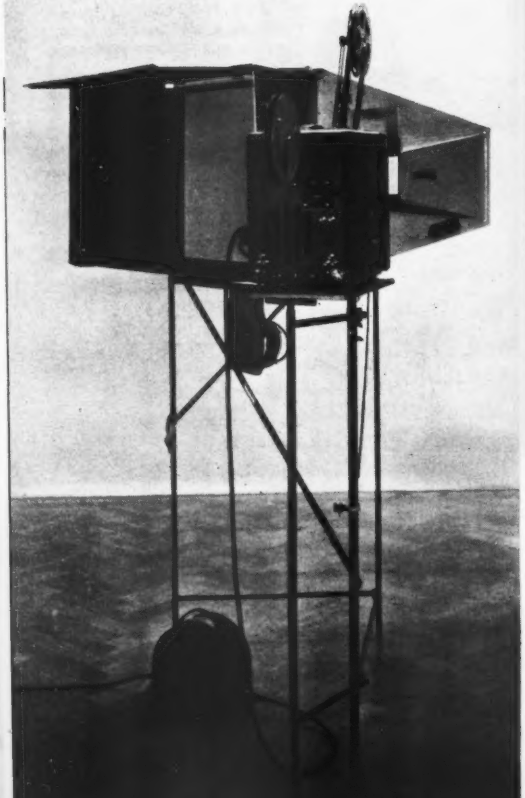
(Above) Spiral film processing spools are moulded in transparent polystyrene by British Moulded Plastics, Ltd., for Kodak Ltd. ("Plastics," September, 1950, page 246).

(Above) Cores for 35 mm. and 16 mm. film, moulded for Kodak Ltd., by E. K. Cole Ltd., and E. Shipton and Co., Ltd.

(Right) Cinematograph reels made from paper base phenolic resin bonded laminate, as well as film transit cases made from vulcanized fibre, are fabricated by J. Burns, Ltd.

(Left) Plastics spools moulded by London Moulders Ltd., are used in the film processing equipment made by W. Vinten Ltd.





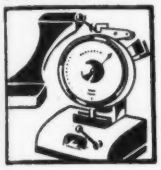
(Above) 5-in. diameter hub, moulded in Bakelite urea by Case Development Co. Ltd., is used on the Premier Patent spool manufactured by Robert Rigby Ltd. (Photo : Bakelite Ltd.)

(Above and right) Welvic p.v.c. paste made by I.C.I. Ltd., is used by J. Arthur Rank Studios for making fruit and similar articles to be used as film props.

(Left) The Daybrite portable back projection unit by Stableford Screens, Ltd., incorporates a highly translucent sheet plastic screen.

World's Industry Employs Plastics

MATERIALS and TESTING



Quality tests for Teflon.—Defects in p.t.f.e. components can be due to spots, porosity, or dimensional instability acquired during processing. Effects on electrical and mechanical properties are discussed. Two simple tests showing up porosity or other weaknesses are dye penetration and bending. (*Materials and Methods*, 1953/July/65.)

Fluorocarbon plastics.—The possibilities and applications of the two types at present available in America: Teflon and Kel-F are discussed, other similar materials are soon expected. (*Materials and Methods*, 1953/Apr./110.)

Silicone-treated porous nickel sheet has been developed by Micro Metallic Corp., 30 Sea Cliff Ave., Glen Cave, N.Y., as a venting media for enclosing electronic equipment, such as aircraft instruments. It will not pass water at less than 3 p.s.i. pressure difference, but will pass air freely. (*Materials and Methods*, 1953/Apr./156.)

Hard rubber.—R. H. Warring shows how hard rubber preceded plastics for industrial use. It is now available in the form of sheet, strip, rod, extruded, moulded or machined components. Physical properties make it suitable for a wide variety of applications particularly in the chemical industry. Porous hard rubber is suitable for separators in storage batteries. Laminations of hard and soft rubber provide both mechanical and chemical protection for lining steel tanks. (*Machinery Lloyd* (*European Edition*), 1953/July/55.)

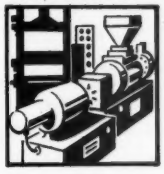
Compression test on elastomers.—J. I. Belfer describes methods for the determination of these properties at low temperature. (*A.S.T.M. Bulletin*, 1953/May/43.)

Pyrolysis of polymers was carried out by S. Straus and S. L. Madorsky in a vacuum in the temperature range of 250 to 400° C. Materials of the styrene acrylate and isoprene group were tested, the volatile products were collected and fractionated. (*Journ. Research*, Nat. Bur. Standards, 1953/Vol. 50/165; Research Paper 2404.)

New electrical insulating materials.—The application of Silastomer R. Tape supplied by Midland Silicones, Ltd., is described in detail. (*Practical Engineering*, 1953/May 22/541.)

The elastic properties of polymers are measured by ultrasonic waves at the Bell Telephone Laboratories. The plastic is placed in a water-filled tank, at one end of which a high-frequency piezo-electric crystal is mounted, while at the opposite end an absorbing pad is arranged. Light waves pass through the tank at right angles. Interesting band patterns result. (*Bell Laboratories Record*, 1953/May/173.)

PROCESSES : MACHINERY



Vacuum forming.—The new rigid polystyrene materials make possible the production of large thin parts by this technique, which is also useful for some cellulosic and vinyl materials. (*Materials and Methods*, 1953/May/94.)

Film extrusion.—A. Romanowski deals with the problem of producing thin films for packaging purposes from polyethylene, polyvinyl chloride, polyamides, polyurethanes, cellulose acetobutyrate and monochlorotrifluoroethylene. Further processing of the extruded tubing by cutting, welding and printing is also described. (*Kunststoffe*, 1953/Apr./134.)

Detecting metals in plastics processes.—H. Schaffrath discusses the physical theory and practical design of electrical metal detectors using the change in a magnetic field caused by conductivity or ferromagnetism of the metal contamination present. (*Kunststoffe*, 1953/Apr./138.)

Mould opening forces and ejection force.—H. Gastrow, the pioneer of the hydraulic injection machine, uses mathematical methods to determine the stress in the mould due to the mould opening forces. Data for design and production of moulds are derived. (*Kunststoffe*, 1953/Apr./141.)

Metallizing plastics.—M. Kollmar gives data on composition treatment and application of fluid precious metal compositions for plastics and ceramic materials. (*Metall* (Berlin) 1953/June/427.)

MISCELLANEOUS USES

Rubber parts.—A 15-page survey gives properties, applications and methods of manufacturing both synthetic and natural rubber components. (*Materials and Methods* (*Materials and Methods Manual* No. 95), 1953/July/95.)

Embedding brittle wood specimens.—J. F. Levy has found in polyvinyl lactophenol a useful material for embedding specimens of ancient wood for sectioning. (*Nature*, Vol. 171, 1953/984.)

Packaging of silverware.—Plastics heat-sealed containers have been found satisfactory for packing most pieces of silverware. For some pieces plastics containers are not suitable and paper must be used. General information of cleaning and packing is also given in this report. (Question and Answer Service Report, IR 10059; T.I.D.U. microfilm.)

Sprayed vinyl roof.—An unusual roof construction in a house at Sarasota, Florida, U.S.A., consists of ½-in. by ⅛-in. cold-rolled steep plates at 12-in. centres spanning 22 ft. between posts in a catenary curve. Fibreboard and 2 in. of flexible insulation are clipped on top, then a cocoon is formed by spraying roof and ceiling with a mixture of saran and vinyl plastics with a final coat of clear vinyl. Rain water drains off the roof because the catenary curves are 2 in. shallower at the centre than the ends. The roof is intended to be flexible and the cocooning is sprayed on the underside of the " sandwich " which forms the roof so that the ceiling surface is also free to move and stretch. (*Architects' Journal*, 1953/May 21/642.)

COATINGS and ADHESIVES

Adhesive for polythene.—A new emulsion adhesive for bonding polythene to paper, aluminium foil and other non-porous surfaces has been developed by American Resinous Chemicals Corp., Peabody, Mass. The adhesive, Arcca 980-21d is being used for attaching labels to polythene bottles, in the manufacture of barrier wrap materials and other applications involving non-porous materials. (*Materials and Methods*, 1953/July/118.)

Internal coating for collapsible tubes.—The increased use of aluminium for manufacturing collapsible tubes makes the development of internal coating lacquers of great importance. These may be based on nitrocellulose, ethyl cellulose, vinylites, rubber hydrochloride, or polymethyl methacrylate. High-temperature stoving is usually carried out with araldite or epikote epoxy-type resins. The methods and equipment employed are briefly described. (*Packaging*, 1953/July/52.)

Expanded and Foamed Materials

By A. E. Lever, A.I.R.I.

In this article the author reviews the published information on expanded and foamed materials. Methods of expansion and properties resulting therefrom are noted and details are given of various materials suitable for these techniques. The literature references are summarized at the end of the article.

ANY review of the various cellular products has to clarify the nomenclature of the various cellular products being offered, and even though several suggestions (1, 2, 3, 4, 28) have been made for classification there is still some looseness in the literature when various products are being described.

It is, however, generally agreed that there are only two main groups of cellular materials:—

1. Sponge materials—in which the cells are intercommunicating.
2. Expanded materials—in which the cells are independent non-intercommunicating units.

Methods of Expansion

To obtain a cellular product each polymer must be handled differently according to its nature and the end product desired, and it must be able to hold the generated gas in the cells without collapse to produce cells of uniform size.

The final size of the cells is dependent on the crystal size of the blowing agent, the stress release temperature of the resin and the quality of the dispersion of the blowing agent. The last two apply when the gas is incorporated under pressure.

Sodium bicarbonate has been commonly used for many years and all common thermoplastics can be blown with it, but the trend recently has been to use nitrogen generating blowing agents (see below).

The following are some of the manufacturing methods used:—

1. The material is made into a mass of low viscosity and is then foamed, with or without foaming agents, by mechanical agitation. When solidified the foamed mass retains its cellular structure.
2. The material is formed into a soft dough and a chemical blowing agent is evenly dispersed throughout the mass. Heat is applied and the material is converted into a cellular product.
3. A soluble solid is dispersed in the material and, after moulding, the solid is leached out, leaving voids which form the cells, e.g., sodium chloride dispersed in the material and leached out by immersion in water.
4. An inert gas is forced into a soft dough under high pressure. On release of the pressure the mass becomes cellular by expansion of the gas. The cellular structure is fixed by vulcanization, hardening by chemical means, etc.
5. The inclusion of a solvent in a soft dough and quick evaporation of the solvent to leave a cellular mass.
6. A fibrous filler and a blowing agent are mixed to give a porous product.
7. Reaction products which, in making the plastic, release one or more gases to form a cellular product.
8. A compound, containing the blowing agent, is mixed on hot rolls, or a Banbury, and then passed through a mechanical extrusion screw press where the resin is plasticized and the blowing agent is decomposed. The foam is then shaped through a rectangular die and cooled.
9. The compound is placed between two sheets of aluminium which act as output electrodes to an ultra H.F. oscillator.
10. A small percentage of acetylene black is added to the compound which will give a high resistance having sufficient conductivity to provide for resistance heating at 110v. and 60 cycles.

Properties

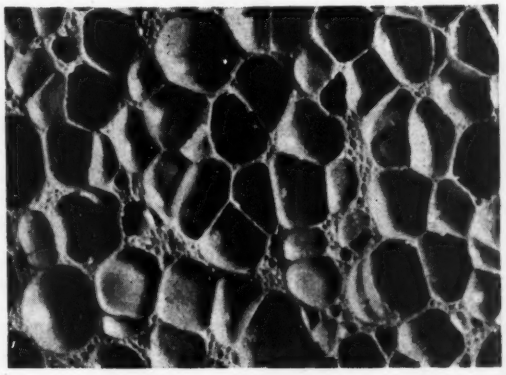
In selecting a cellular material for a particular purpose the following properties should be considered according to the ultimate use:—

1. Thermal Conductivity

This is defined as the amount of heat (in B.Th.U.) that flows in one hour through a material one square foot in area by one

Table 1.—(1.5.27).

Material	Density lb./cu. ft.	Thermal Conductivity. B.Th.U./sq. ft./hr./1in./1pF.	Tem. Range. °C.
Expanded :			
Ebonite	4.0	0.20	-10 to 0
GRS Ebonite	4.0	0.20	0 to -20
Soft Rubber	8.25	0.28	0 to -19
Phenol Formaldehyde ..	6.3	0.28	1 to -19
Polyvinyl Formal	6.0	0.24	0 to -20
Polystyrene	3.0	0.30	0 to -20
Urea Formaldehyde	6.0	0.28	0 to -20
Sponge Rubber	26.0	0.58	0 to 20
Cork	12.0	0.30	0 to 20
Water	62.5	4.60	M.T.20



(Left) Sponge structure. (Right) Expanded structure. Photos by courtesy of The Expanded Rubber Company Ltd.

inch thick, when the temperature difference between the surfaces is maintained at 1° F. The nature of the material, the density and type of cell structure will affect the results.

Completely closed and even cell structure is the ideal type and Table 1 gives a comparative seelction of various materials.

All such figures should be treated with some caution as the composition of the material is not quoted, nor is the nature of the gas in the cells of the expanded material, both of which may have a profound effect on thermal conductivity.

A. Cooper (5) gives an interesting account of expanded rubber as a thermal insulating material and some applications are discussed and illustrated. M. Hickman (27) discusses the modes of heat transfer through a cellular type of heat insulator and data is given for various cellular plastics in sheet form, including in addition cellular concrete, glass, alginate foam, etc.

2. Water Absorption

This is an important property for most applications.

With the sponge type of cellular material the water absorption will be higher than in the expanded type but in some cases will be essential, e.g. a rubber sponge for bath uses. On the other hand where the material is to be used for insulating purposes, or where buoyancy is desirable, then low water absorption is desirable, and here expanded materials are superior to the sponge type. High water absorption would be dangerous for materials which are subjected to low temperature conditions as they would become water-logged, ice would form in the cells and break up the medium, quite apart from the fact that water in the cells would reduce the efficiency of the material.

Low density, high water resistance coupled with the non-intercommunicating cell structure of the expanded type of materials make such products eminently suitable for purposes where a high degree of buoyancy is required, e.g. buoys, pontoons, life-saving equipment, etc.

3. Density-strength Ratio

This is better expressed by stating that low density should be combined with high strength.

For structural work it is necessary to sandwich the cellular material between two layers of plywood, metal, etc., using the former as a core (see below). This increases the strength and stiffness.

4. Resilience

A property more perhaps associated with sponge products as for instance when considering the use of sponge rubber for upholstery.

5. Sound Conductivity

Most cellular materials are not usually considered suitable as sound insulators but some may be suitable as reverberation absorbants, e.g. granulated bonded expanded ebonite which is 20% more efficient than felt.

6. Electrical

Electrical properties of cellular materials are usually in line with those of the solid materials.

Table 2—Electrical Properties of Expanded Materials (1).

Material	Density lb/cu. ft.	Power Factor% 1,600 CPS	Permaty. 1,600 CPS	Resistivity ohms. Volume	Breakdown Voltage V/M
Ebonite ..	12	2.00	1.10	$2^{*}\ 10^{17}$	63
Soft Rubber ..	18	0.90	1.20	2×10^{16}	101
P.F. Resin. ..	8	2.30	1.30	2×10^{13}	36
P.V. Formal. ..	8	1.30	1.10	$> 10^{15}$	135
Polystyrene ..	10	0.60	1.20	7×10^{15}	50

7. Fungus and Vermin Resistance

This is an important property for materials that are to be used in permanent structures for heat insulation, cores for structural use, and packaging. In all cases, of course, where the material is to be used in the tropics.

8. Flammability

Non-inflammability is essential for some purposes, e.g. when used in aircraft but for some purposes a low inflammability, i.e., self-extinguishing, may be permissible.

9. Fabrication

Ease of fabrication may be important in so far as whether it can be bent to a desired shape, cut with available tools or does it need specially heated knives, etc., and under this heading would come those materials that can be found *in situ* (see below).

Table 3.—Impact Tests on Expanded Materials

Material Condition	Ebonite	P-F	P.V. Formal
Skin both sides	0.10	0.10	2.46
Skin on one face	0.06	0.06	1.48
No skin either side	0.02	0.02	0.50
Skin only	0.04	0.04	0.98
Skin both sides and Dural. one side.. ..	1.18	1.18	3.54
Skin both sides and Dural. both sides ..	2.26	2.26	4.62
Skin both sides and 1/16" ply one side ..	0.72	0.72	3.08
Skin both sides and 1/16" ply both sides ..	1.34	1.34	3.70
Skin both sides and 3/32" ply one side ..	1.50	1.50	3.86
Skin both sides and 3/32" ply both sides ..	2.80	2.80	5.26

All test samples ½" x ½" x 2½" and density 6/7lb./cu.ft.
Unnotched Izod Test piece.

10. Stability

Whether the material will stand up to the temperature, and other special conditions required for a particular purpose such as heat or cold, e.g. Expanded Ebonite will stand temperatures of −150° C. to +50° C. A very slight shrinkage takes place during ageing.

11. Compressive Strength

This is an important property especially when the material is used for packaging. A. Cooper (1) gives some interesting data on the relation between compression strength and density, etc. See also Table 2.

12. Impact Strength

In considering the use of cellular material as a core in sandwich constructions this property is of importance and is dependent on the density. A. Cooper (5) gives some interesting figures which are shown in Table 3.

Table 4.—Physical Properties of Expanded Materials.

Material	Density lb./cu. ft.	Thermal Conductivity B.T.U. at lowest density	Max. working temperature ° C.	Flammability/ min.	Compressive strength p.s.i.	Impact strength ft./lb.
Cellulose acetate	4–8	0.30	150	8.5–4.2	75–175	0.04–0.15
Polystyrene	1.5–2.0	0.25–0.27	80	Burns slowly	20–40	1.5–1.7
Phenol-formaldehyde	2–5	0.24	150	None	10–30	0.005–0.01
G.R.S.	4–5	0.23	60	Burns	50–80	3.0
P.V.C.	10–20	—	65	Varies with plasticizer	—	—
P.V. Formal	6–30	0.24	70	Slowly	170	2.46–3.70
Ebonite	4–30	0.19	150	Burns	60	0.10
Thermazote	7–30	0.28	250–300	None	100	—
Plastazote	6–30	0.24	70–80	Burns slowly	170	—

Materials

Most plastics have, at some time or other, been offered in foam or expanded form, but not all of them have attained commercial importance. Other than cakes and biscuits which have used bicarbonate as the blowing agent for many, many years, the first commercial material seems to have been Onazote (43), an expanded ebonite patented in 1921, and for those interested, several references have already been quoted, 1, 3, 5, etc.

Chlorinated Rubber

Excepting those cellular products based on rubber, expanded chlorinated rubber was possibly the next in order of importance to be produced (8, 9, 43), and is made by heating the chlorinated rubber to about 165° C. followed by release of pressure (from mould or extrusion). It can be readily moulded or cut to shape, and a volatile liquid is used as the blowing agent, but this may vary with some types of chlorinated rubber. The low thermal conductivity of the expanded material is attributed to the fact that the cells contain HCl gas (1). It is non-inflammable.

Polystyrene

Foamed polystyrene is often made in familiar ways by expansion in open moulds, which results in large pores, or in closed moulds giving smaller pores (25), and in the patent to which reference is made, it is suggested that the special blowing agent used (diphenyl-4, 4'-di (sulphonyl azide) insolubilizes the resin by cross-linking.

Foamed polystyrene found its first application as a buoyant material for marine rescue equipment (24, 29), but is now used very largely for cold storage plant, refrigerators, and also for toy figures. It is sold in blocks and the first thing to do in fabricating for some purposes is to remove the outside layer. This can be done with a band saw and it is then sliced into sections of the size required for machining on standard lathes, circular saws, drills, etc.

It can also be formed by a kind of extrusion in which strips of the foamed blocks are forced through a heated metal die.

All the scrap may be used to make smaller objects, such as Christmas toys, or ground into powder, packed into a container and used for insulation (30). It is also used for light weight, shock absorbing and protective packaging, and it should be noted that where the contents of the package is liquid, the foam will give good protection against freezing (31).

Phenol-formaldehyde

In 1944 a combination of all-wood kraft paper and phenol-formaldehyde resin was used to make a honeycomb form of packaging, and marketed under the name of Dufaylite (15), and other applications were suggested at the same time, such as caravan roofs, furniture, etc.

Another p.f. expanded product sold under the name of Thermazote (17, 23), which was developed specifically to meet the requirements of good heat resistance, and thermal insulation.

It is offered in densities between 7 and 30 lb./cu. ft. (s.g. 0.12 to 0.5) and, at the lowest density, has a compression strength of 100 p.s.i. One cubic foot of the material, of a density of 7 lb./cu. ft. will support 55 lb. of soft iron in fresh water. It is non-inflammable and will withstand temperatures of 250-300° C.

The fluid phenolic is mixed with an acid catalyst at room temperature, aerated with a mechanical stirrer, and poured into a simple mould. Continued expansion to about 200 times the original volume of the material, fills the mould in 15 to 30 sec. After a short holding time, the block is discharged by opening the sides of the mould. It can be cut and machined in the normal way and has a density of 0.3 to 0.4 lb./cu. ft., is non-inflammable, fungus resistant, and is similar to glass wool in insulating properties. Although the resin is unaffected by water, it will absorb water and moisture unless protected by a moisture-proof barrier. It is of sufficient unicellular structure to remain buoyant even after long immersion in salt water (29).

Because of the grain effect produced during the expansion, heavy articles are packed parallel to the grain for maximum compressive strength. Phenolic foams are being produced for packaging and are offered in 5-ft. cubes, which can easily be lifted by one man, and weigh about 1/7th as much as good-quality shredded paper packing (35).

Polyvinyl Chloride

Both expanded and foam polyvinyl chloride are manufactured.

To produce a cellular polyvinyl chloride, a plastisol is compounded in which is incorporated a nitrogenous or other blowing agent. The mixture is poured into a mould and heated. This decomposes the blowing agent and the gas formed, applies extensive pressure against the walls of the cells formed. The type of mould determines the amount of expansion. If an over-size (i.e. low pressure) mould is used, the compound expands up to 10 times its original volume. When, however, an under-size (i.e., high pressure) mould is used, the material is confined to a fraction of its final size. In both cases the product is cooled before removal from the mould, and in the latter case, in addition, the foam is then warmed to its softening point allowing it to expand to its final size. If the compound is blown against atmospheric pressure, i.e. in a mould that is not completely closed, an open cell structure results.

Sodium bicarbonate can be used as the blowing agent but other types have been developed in recent years, mostly those giving nitrogen gas when heated.

Porophor N (azo isobutyric dinitrile) was used in Germany during the war but it was very toxic to use. A formulation for cellular p.v.c. is given (19) as follows:—

Igelit PCU	48
T.C.P.	32
Porophor N	20

Cure: 5 minutes at 160° C. plus 30 minutes at 80° C.

Other blowing agents have since been developed which avoid the toxicity of the above.

Vulcacel B.N. (I.C.I.) is a soft, cream-coloured powder s.g. 1.40. It is stable to alkalis but mineral acids initiate decomposition. Up to 5% by weight of the final paste is used, and moulded in a manner described above. The heating suggested is 25 min. at 160° C. and then followed by treatment in hot air for 20 min. at 100-110° C. for final expansion.

Another series sold under the name "Genitron" is very interesting (20):—

		Blowing Temp. °C.
Genitron	A.B.	90-100
	N.H.	85-95
	O.B.	130-150
	A.C.	200-240

Celogen (10) is a new nitrogen foaming agent which it is suggested is suitable for expanded p.v.c. When the moulded product is removed from the mould it is expanded to its final size after further heating.

Net floats of cellular p.v.c. are being used having the advantage that they will withstand pressures that would collapse ordinary metal and hollow plastic floats, and yet have excellent buoyancy, light weight and are unaffected by sea water, oils, etc. After 24 hours at a pressure equal to 75 fathoms of water, the water absorption was less than 2% Density 5 lb./cu. ft. (16).

One company announces (33) a new principle of plastisol formulation which permits the production of expanded sheetings and coatings.

Neither pressure nor moulds are required and two pounds of the wet material expanded to a density of 20 lb./cu. ft. will

yield one square yard of ⅛-in. foamed sheeting. The size of the cells can be controlled.

Porvic, a brand of microporous p.v.c., has been developed by Pritchett and Gold & E.P.S., Ltd., and is now being manufactured in several of the company's plants in Britain. At the moment it is being used as a battery separator and experimental work is being continued in the laboratories of the company to produce variations of the Porvic material by incorporating plasticisers.

Cellulose Acetate

Cellular Cellulose Acetate has been developed primarily as a structural core. Two methods are adopted for the formation of the cellular product (21, 22):—

1. The cellulose acetate is expanded between heated platens and has an oriented fibrous structure very similar to balsa wood. The size of the cellular product depends on the area of the platens.
2. Extrusion and blowing and the material is isotropic.

Rheinfrank and Norman (22) give some interesting illustrations of the types of failure that may occur with sandwich structures.

When cellulose acetate is expanded in a compression mould the cells can be made to lie parallel to the movement of the plunger similar to the directional grain found in balsa wood.

It is not recommended for thermal insulation and is made in densities of 4-8 lb./cu. ft. It can be formed or shaped at about the softening temperature of 390-400° F. and hot shaping dies should be used. Close temperature control is necessary.

Polyurathane (Isocyanates)

In one type, two alkyds and an aromatic diisocyanate are mixed and then water is added causing the mixture to foam in situ without heat. As will be appreciated this foaming in situ has considerable advantages and is used in randoms between the inner and outer shells where it forms up to fill the cavity. It also bonds satisfactorily to the skins without an additional adhesive. In some cases it can be sucked into cavities through holes which are too small for pouring, casting, etc. (15).

Isocyanate foams are also used for strengthening the trailing edges of the wings and elevators on aircraft. It is foamed round a core of hard rubber foam. This type of foam was developed during the war in Germany under the name Moltopran (18).

Polyvinyl Formal

This expanded material is mainly used for sandwich structures and is important for its very high impact strength (17, 23) and a density of 6 lb./cu. ft. has a compressive strength of 170 p.s.i. Other details are given in Table 4.

Urea-formaldehyde

U.F. foams were produced in Germany during the war and used mainly for insulation on railways, being bonded into place on tank cars by bitumen pitch. The process of manufacture was quite complicated and some details are given in reference (18). It was quite fragile and had only limited water resistance.

Neoprene

Reference (12) gives full details of formulations, manufacturing technique, tests and a very good bibliography of U.S. patents.

The advantages of Neoprene Foam are:—

1. Good resistance to fungus.
2. Good chemical resistance.
3. Does not support combustion.
4. Good ageing.
5. Good flex resistance at normal and elevated temperatures.

Miscellaneous Products

Ensolite, a product of the U.S. Rubber Co. (32) is being used for lightweight battle suits for the U.S. Navy. It absorbs shock impact blows, does not absorb perspiration and will float for long periods. It is available in densities ranging from 4 to 15 lb./cu. ft. in sheets ⅜ in. to 1½ in.

Royalite (34) is a butadiene-acrylonitrile-styrene-acrylonitrile copolymer and is offered for life-saving rafts, sun helmets, fishing floats, etc. It is a good thermal insulator and is sold in sheets 46 to 17 in. and from ¼ to 1 in. thick.

H.S.160 (36) is a foamed Hycar O.R.15, phenolic resin and nylon mixture. Azo diiso-butyronitrile is the blowing agent. It is used for filling aeroplane propellers. After foaming under 300° F., the compound cools into a light rigid structure which fills every portion of the aperture between the propeller core and blade edges and the hollow core itself, thus keeping the propeller blade shell from vibrating in and out under extreme pressures. It has a high impact and fatigue strength.

General

Honeycomb Cores

These are not strictly expanded products but are noted here as performing similar functions in some respects to cellular plastics. They consist, briefly, in the impregnation of glass fibre cloth with a resin and then corrugating and curing. The "high spots" of the corrugated sheets are coated with an adhesive and stacked one on top of another to form the honeycomb structure. The whole is then cured (39, 40, 41).

Sandwich Constructions

A useful article (26) discusses the various theoretical and practical aspects of sandwich constructions and should be consulted by those interested. Various types of sandwich constructions are discussed and illustrated in reference (29).

Cellular Rubber

Apart from the references given above, there is a useful discussion on the A.S.T.M. system of test methods for cellular rubber in A.S.T.M. Standard on Rubber Products with a useful condensed key to this system in Neoprene Notebook, Nov., 1952, p. 333. Pettigell (37) discusses briefly the uses of Ribazote and Pliofilm in packaging. Gould (42) reviews information relating to cellular rubbers and is worth studying.

Polythene

Foamed polythene is claimed (38) using diphenyl-4.4'-di (sulphonyl azide) as the blowing agent.

References

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Paris Plastics Exhibition

The Second International Chemical Exhibition incorporating a large and representative plastics section was held in Paris at the end of June, 1953. Outstanding features were the widespread use of rigid vinyl materials for chemical plant, the growing interest in reinforced polyester resin structures and the wide range of machinery particularly extruders and injection-moulding machines.

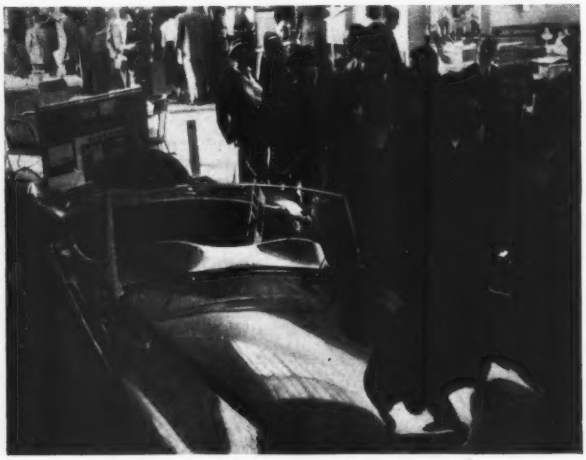
FOLLOWING immediately after the British Plastics Exhibition in London, the 2nd International Chemical Exhibition in Paris gave an opportunity of comparing the plastics industries of Britain and France, besides showing for the first time a number of interesting new machines and new materials. The fact that the "Grand Semaine des Plastiques" or Great Plastics Week formed part of an international technical exhibition and congress contributed largely to its success, and enabled the industrial side of the industry to show its true capacity in comparison with the household and fancy goods trades more familiar to visitors of the plastics section at the Foire de Paris. However, consumer goods were not forgotten and exhibits such as melamine tableware, p.v.c. aprons and hanging wardrobes were also to be seen outside the exhibition in special window displays organized by the big stores to support the "Plastics Week."

The growing plastics material producing capacity of France was well demonstrated at the exhibition. Two new polystyrene plants, Péchiney and Monsanto-Bussois, have recently gone into production. Solvic are commencing production at France's third p.v.c. resin plant, which is to have an initial capacity of 4,000 tons per year with expansion plans for 10,000 tons. This may be compared with the present French total p.v.c. production of 12,000 tons. A new company, Ethylene-Plastique, understood to be financed by Péchiney and I.C.I., is constructing a plant to produce polythene under I.C.I. licence. Silicone resins and elastomers are now produced by Saint-Gobain and by Rhône-Poulenc. Amongst other new materials it is interesting to note several manufacturers of polyester resins, some based on French, others on American, formulations.

Reinforced polyesters are arousing considerable interest and the American car shown by the agents for Vibrin resins was usually surrounded by visitors. The French industry is handicapped by the fact that only woven glass reinforcement is available so far, since glass mat is not yet produced. One exhibitor showed a number of chair shells, already in production, using woven jute as the reinforcing filler. This gives thickness, rigidity, and low weight, without sacrificing unduly the strength of the laminate. Outlets as in Great Britain are, so far, restricted principally to the aircraft and boat-building industry, with great interest being shown in other fields, particularly motorcar bodies.

Nylon appears to be far more widely used than in this country, in both moulded and extruded form. Exhibits included components for textile machinery, electrical equipment, gears, etc. In the field of extrusion a strip to replace rattan for woven furniture has the advantage of strength, durability and colour over the natural equivalent. Polyamides are also in use as surface coatings for p.v.c. and are claimed to give a better finish and increased wear-resistance. Latest development in the textiles application of nylon is a nylon fur which was shown at the exhibition.

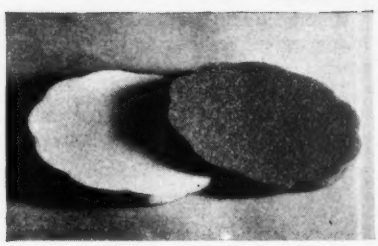
In the chemical section of the exhibition, fabrications from rigid p.v.c. were seen everywhere. A high degree of skill in welding has been brought to this fabrication technique and all types of chemical equipment, such as tanks up to 20 cu. metres capacity, ducts,

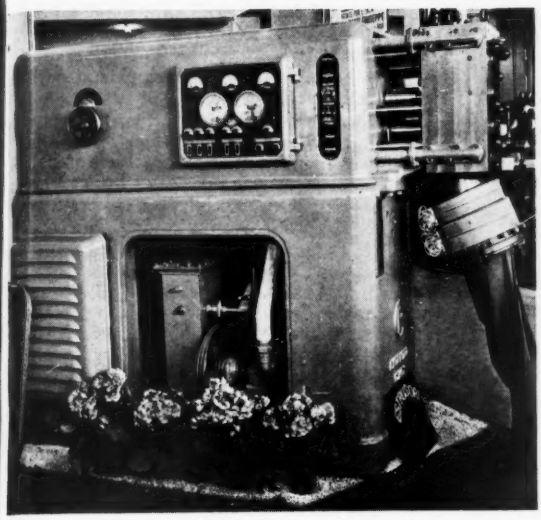


(Right) Liquid packaging in p.v.c. by series-welded bags filled along a common feeding tube.

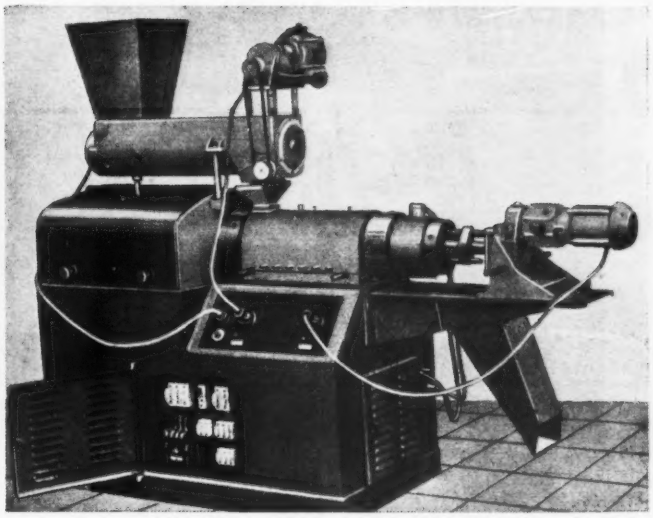
(Left) American sports car with glass-polyester resin body.

(Right) Table-mats cut from expanded p.v.c. material.





Pasquetti bihelical gear extruder.



Mapré twin-screw extruder with granulating cutter.

ventilator fan assemblies, valves, etc., are being made. Most equipment of this type is fabricated but a rigid p.v.c. bucket of 13 litres (nearly 3 gallons) capacity on show is being produced by compression moulding.

P.V.C. film and polythene are extensively used in packaging, as drum liners, etc. A large square " bottle " welded from p.v.c. film is filled with liquid, placed in a carton, and is accepted with no further protection for conveyance by French Railways. Injection moulded plasticized p.v.c. components are made in quite large sizes: a motorcycle saddle moulded from Saint-Gobain material on an Eynard machine weighs 800 grms. (28 oz.). This saddle has been in production for three years.

Whereas the mouldings and fabricators represented at the exhibition were almost exclusively French, material manufacturers and more particularly machinery manufacturers from nearly every producing country were represented. Great interest was shown in the many new designs of extruders and injection moulding machines from France, Great Britain, Italy, Germany, Luxemburg and the U.S.A. Other machines of interest to the plastics industry, including h.f. welders and heaters, grinders, granulators, mixers, vacuum equipment, and packaging machinery, were shown in other sections of the exhibition.

The following notes describe some of the details of machines new or unfamiliar to Great Britain.

Extruders

A series of novel machines for compounding and extruding thermoplastic materials was shown by the Italian company *Carlo Pasquetti*, of Varese. The largest of these machines has an output of 440 to 665 lb. per hour depending on the material and the particular extrusion jobs. The compounding and plasticizing is carried out by a series of three pairs of helical gears kept at a thermostatically controlled temperature by means of a circulating oil system. The machines have been designed principally for making granules of moulding materials and with the vertical die-head a cutting mechanism can be attached below. Another use which the company is developing is the extrusion of p.v.c. sheeting for subsequent embossing. This obviously offers advantages over the costly equipment required for the modern calendering plant. The machine can also be fitted with a right-angle horizontal die-head and normal take-off equipment for producing tubing, etc. Details of the two models at present in production are:—

Model	C.P.I.300	C.P.I.100
Capacity per hour	440-665 lb.	220-330 lb.
Driving motor	27 h.p.	16 h.p.
Gear diameter	5½ in. each	3⅜ in. each

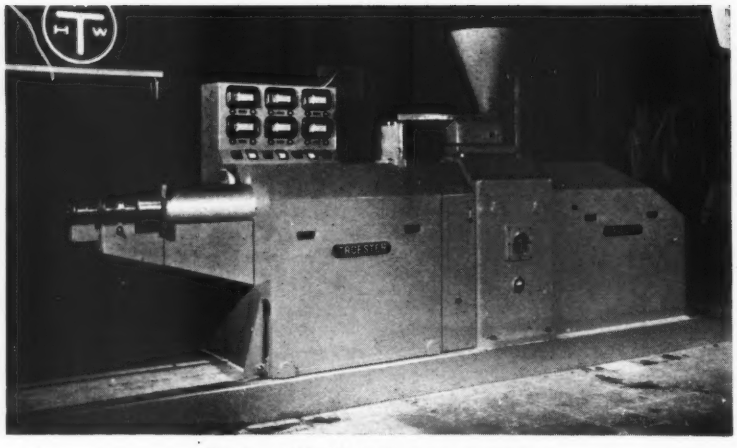
In addition to the double helical gear extruders Pasquetti also produces twin-screw extruders of usual design.

Details of these machines are available in England from T. H. and J. Daniels, Ltd., Stroud, Glos.

Another series of twin-screw extruders with several noteworthy design features was shown by *Mapré S.A.*, Diekrich, Grand Duchy of Luxembourg. There are two machines, the smaller driven by a 7.5-h.p. motor has a maximum output of 45 kg. per hour (100 lb. per hour) and the larger one with an 11-h.p. motor produces up to 65 kg. (140 lb.) per hour. The general design features are the same. The twin screws are characterized by square-section threads intermeshing so that positive forward thrust is ensured along the whole length and no " dead spots " can cause decomposition of material. The barrel as well as the screws can readily be removed from the main body of the machine to which it is attached by a bayonet-type fixture. Runners enable the barrel to slide out, facilitating cleaning for change of colour or material. There are three electric heating zones along the barrel as well as cooling coils suitable for circulating air, water, oil or other cooling media. The feeding unit is designed to take powder material and consists of a hopper leading to a trough in which an Archimedean screw premixes and feeds the material into the actual machine at a constant rate. The screw is driven by a separate motor and both screw and trough are heated to drag and heat the material. The illustration, which shows the extruder from the back (i.e. the side opposite the control panel) shows a model fitted with a rotary cutter and chute suitable for making injection moulding chips.

The latest model of twin-screw extruder manufactured by *Trudex*, 45 Rue La Fayette, Paris, 9c, incorporates a number of patented improvements over earlier models of this machine. These include electronic regulation of the heating and cooling of the barrel sleeve, with a synchronization device; new device for cooling the screw; automatic measurement of rise in temperature due to friction; feeding automatically variable according to the speed of the machine; and electronic thermostatic control unaffected by variations in electric current. The machine can be used with extrusion compound in granular form but is also intended for use with raw material in powder form, mixed where necessary with plasticizer, filler, stabilizers and colouring matter; this is of great value for extrusion of unplasticized p.v.c., solid rods up to 5 in. diameter having been produced in this material. The screws, each 70 cm. (27½ in. appr.) long and 90 mm. (3½ in. appr.) diameter incorporate an interesting design feature to improve the plasticization of the plastic material. At the tip of each screw-shaft there is a set of flat discs having radial slots cut into them,

Trudex twin-screw extruder.



Troester U.P. 120 single-screw extruder.

thus acting as additional mixers. Heating of the barrel is in three zones with additional heater for the die-head and for the die. Provisions are made for air or water cooling of the sleeve. For blowing of extruded film and sheet a special circuit regulates blowing pressure. Material feed under pressure is by a volumetric screw driven by a variator controlled on the switchboard by a servomotor and push-button. The average output of the machine is 120 kg./hr. (260 lb./hr.).

A German company, *Paul Troester Machinenfabrik*, Hanover-Wuelfel, showed an interesting single-screw plastics extruder representing a range of machines from 1¼ in. to 6 in. screw diameter. The illustration shows model U.P. 120 with 4¾ in. screw diameter. This machine has a 50 h.p. driving motor and six electrically heated zones. Special features of these machines include interchangeable screws—some five different standard designs being available for various materials and applications; a unit assembly system-drive housing, control panel and extrusion cylinder all being separate; stepless speed regulation by oilgear; electromagnetic coupling. Not only are the screw designs different but different lengths of screws can be used together with an extension of the cylinder. The whole of the cylinder is mounted on rails and can be rolled forward completely clear of the screw. Safety devices such as different colours and designs for plugs and sockets make it impossible to reconnect the heating and control circuits incorrectly. Cooling of the cylinder is by regulated air blast. This company also supplies take-off equipment for various purposes and they specialize in the installation of film extrusion-blowing plant, having supplied over 30 of these throughout Europe.

An injection moulding machine with vertical pre-plasticizing unit, model P.V. 400, was shown for the first time by *J. F. Bas and Co.*, for the manufacturers *Sté. Viennoise de Constructions Mecanique*, Vienne (Isère). The machine has a maximum shot capacity of 400 grms. and a plasticizing capacity of 20 kg. per hour. The max. cycle time is between 3 and 4 per minute. The most unusual feature of this machine is the locking device. Closure of the press is by a toggle which is so designed that it locks at the end of the stroke, locking pressure being applied, hydraulically, through the rams formed by the locked toggle joints.

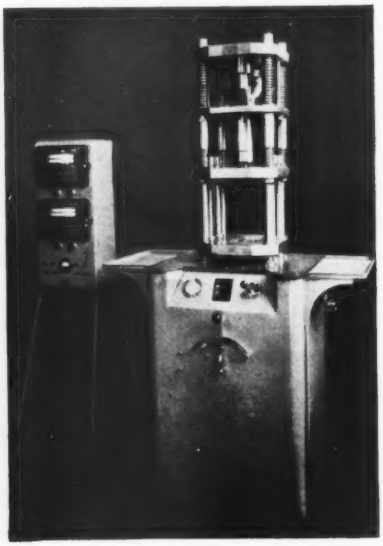
Another product of the same company is the Giroplastic granulating machine of the rotary cutter type. It is made in three sizes B.V.1: 1 h.p., 15-30 kg./hr. output; B.V.4: 4 h.p. 60-140 kg./hr.; B.V.20: 20 h.p. 700-1,000 kg./hr.

The vertical injection-moulding machine manufactured by Ets. *A. Lepetit*, Montrouge (Seine), has been designed principally for injection moulding nylon. By means of several ingenious design features including balanced locking pressure through both platens this machine gives a shot capacity of 100-120 grms. An intricate nylon moulding for textile machinery currently being produced on one of these machines weighs 150 grms. (5⅓ oz.). An "interlock" system with variable setting controls locking pressure proportional to injection pressure. Control is by a single lever with safety interlock. The injection chamber and the fixed plunger are detachable for changing or cleaning. The nozzle may be removed or changed without disturbing the injection chamber, a special nozzle being fitted for polyamides. There are two thermocouples; temperature control is housed on a panel separate from the machine to ensure the accuracy and sensitivity required for polyamides. The hydraulic generator is also housed separately behind the press.

Another series of vertical injection-moulding machines is produced by *Les Machines Foucher*, Arcueil (Seine), who are represented in Great Britain by Lavino (London), Ltd. These range from a new bench-type 12-grm. capacity machine to a 500-grm. machine over 12 ft. high with a 300-ton closing pressure. The advantages of vertical design lie partly in the saving of floor space and partly in the ease with which inserts can be incorporated. It is also claimed that three-plate moulds with automatic gate stripping are easier to operate on these machines.

The 1,200-grm. machine by *Eynard*, of Lyon, was also shown at the exhibition. This machine was developed a few years ago and has proved quite successful. An even larger machine called the "Cathedrale" is now also being built.

Other injection-moulding machines shown were the all-mechanical press made by *J. Facon* in France under licence from Battenberg, the U.S. *Fellows* automatic machine (described in *Plastics*, Feb. 1953) and the British-built *Herbert-Reed-Prentice* machine.



(Left) Lepetit 120-grm. vertical injection moulding machine.

(Right) Presses Viennoises 400-grm. pre-plasticizing injection moulding machine.

Glass-bonded Mica Insulation

By A. E. A. WRIGHT,* A.M.I.E.E., D.F.H.

The material described in this article being, as the name implies a combination of glass and ground mica, cannot, strictly speaking, be included in that group of long chain organic compounds normally associated with the word plastics. Glass-bonded mica, however, both in its methods of fabrication and its application as an electrical insulator is so akin to conventional plastics materials that it is of great interest to examine its properties and uses. The author gives test figures for electrical, mechanical and thermal properties for both compression-moulded and injection-moulded forms; some recent applications of both forms are described. Increased requirements of electrical and thermal properties in modern electrical equipment should widen the scope of glass-bonded mica and in this connection it is interesting to note that experiments are being undertaken in the U.S.A. for combining the material with polymers such as polytetrafluoroethylene and polytrifluorochlorethylene, thus bringing it even closer to the field of plastics.

THE conception of bonding finely ground mica and glass together and sintering them to provide a good insulation, occurred to several minds early in the century when the electrical industry was relatively in its infancy. The insulating properties of such a material were obvious and, in fact, far too good for all but a minor section of the industry then branching out into radio.

The position at the present day is very different in that glass-bonded mica insulation potentialities are being realized more fully as more rigorous service is continually being demanded of insulation generally, as, for example, higher rupturing capacity for switchgear and the higher and higher frequencies on H.F. work.

Introduction

Glass bonded mica can be compression and injection moulded to almost any shape for many purposes. The compression moulded material is available in the form of sheets, rods and pieces cut to order. There is no great difficulty in machining with ordinary machining tools, provided the technique is thoroughly understood. The injection moulded material is made from injection or transfer moulds in a very similar manner to normal plastics mouldings except that much higher pressures and temperatures are employed. The advantage, from the mechanical point of view, compared with most plastics, is that there is no shrinkage or warping after moulding and, therefore, very close tolerances can be maintained, particularly as the coefficient of expansion is very similar to that of most usual steels.

Another important advantage is that inserts can be moulded in position, unlike the ceramics where they have to be inserted afterwards by another process.

Electrically, glass-bonded mica is interesting in that the superior electrical qualities of the mica, such as low power factor, high surface and volume resistivity, and good dielectric strength, can be made to combine with low temperature glasses where these properties are relatively poor.

Over a frequency range of 10^2 to 10^8 cycles per second, the power factor varies according to the graph shown for both types of glass-bonded mica, compression and injection moulded.

It is to be noted that the permittivity remains more or less constant up to 10^8 cycles per second.

Another important feature of glass-bonded mica, so far as the power frequency use in all types of switches and switchgear is concerned, is that it is non-tracking and arc resistant since, being inorganic, there are no carbon-forming chemicals in the composition: thermally, the working limit is 450° C. It is also noteworthy that, under conditions of vacuum, there is little or no release of gas. By suitably combining the mica and glass in different proportions, a particular set of required electrical, thermal or mechanical properties can be brought out in the finished article.

Manufacture

In order to appreciate the underlying features of glass-bonded mica, it is considered necessary to deal briefly with an outline of its manufacture for the two types of material, namely compression-moulded sheets and injection mouldings.

* Mycalex Co., Ltd., Ashcroft Road, Cirencester.

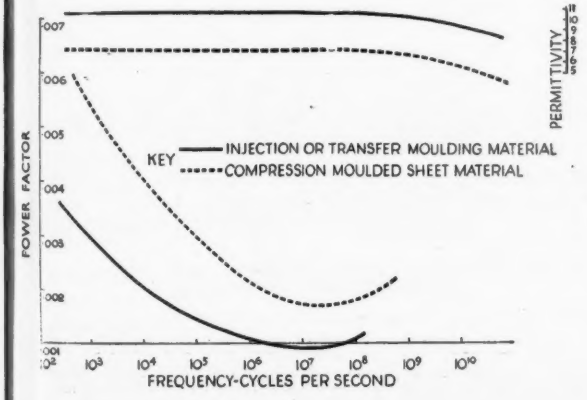


Fig. 1.—Power factor and permittivity of compression-moulded and injection-moulded glass-bonded mica.

Compression-moulded Sheets and Rods

The sheet material is preformed into slabs made from the main ingredients, finely mixed muscovite mica and a borosilicate glass or enamel. The limitation of the temperature of about 650° C. of the glass is imposed because of the disintegration of muscovite mica at much above this temperature. The mica to glass ratio is in the order of 1½:1.

The preformed sheet is pressed hydraulically at about 1½ tons per sq. in. after which it is fired in a furnace at about 650° C. This causes the glass element of the composition to complete its reaction by vitrification so that it combines with the mica. The now semi-molten sheet is taken from the furnace and pressed in a hot press at about 1 ton per sq. in. until it sets.

It is found during the two pressing operations, that the mica flakes tend to orient themselves so that their larger surfaces lie perpendicular to the direction of pressure and parallel to the sheet faces. It is interesting to compare this action with the fact that mica lies in strata in the ground.

After the sheet is cool, it is surface ground to remove a deleterious surface skin of relatively poor electrical quality. The sheet is now ready for forming into rods, panels, formers, etc., by normal machining methods.

Transfer or Injection Mouldings

Glass-bonded mica mouldings are relatively new compared with the sheet material but their use is rapidly overhauling the latter in scope and application. The main ingredients are phlogopite mica because of its greater heat-resisting qualities than muscovite. The other main ingredient is a lead borate glass. Small pellets are preformed from a combination of the mica and glass and heated to fusion point in rotary furnaces at 650° C. Compared with sheet material, however, the mica to glass ratio is lower, so that there is more glass than mica to facilitate flow under pressure and high temperatures into the mould cavities.

The required number of pellets are then transferred quickly to the mould hoppers and the press operated so that the ram forces the molten pellets into the mould cavities through suitably constructed feeds. The mould temperature is maintained at as near 300° C. as possible. The moulding then sets because the mould temperature is lower than the setting point of the glass. Every endeavour is made to impart as good a surface as possible to the mould during manufacture so that the ultimate moulding has, to all appearances, a glass-like surface finish.

Inserts are easily incorporated into the moulding during the moulding process by suitably designed mould cores and pins. There is no distortion, warping or cold flow during or after cooling, and contraction approximates to that of the usual steels. As a result of this small contraction, very close tolerances can be maintained, particularly as the coefficient of linear expansion approaches that of steel.

Table 1. Physical Properties of Compression-Moulded Glass-Bonded Mica.

		Test
Electrical Properties		
Electric Strength	Greater than 500 volts per .001 in.	N.P.L.
Surface Flashover	20kV between electrodes 1 in. apart	B.S. 1539 : 1949
Edgewise Breakdown	Test pieces did not break down at 40kV the maximum voltage available	B.S. 737 : 1937
Volume Resistivity	Greater than 10^{14} ohms per cm. cube	B.S. 1598 : 1949
Surface Resistivity	5 x 10^9 ohms per cm. sq.	B.S. 1539 : 1949
Permittivity	7 average	B.S. 1598 : 1949
Power Factor	1 Kc/s .007—.009 1 Mc/s .022 average	B.S. 1598 : 1949 N.P.L. Test
Mechanical Properties		
Specific Gravity	2.68 average	B.S. 1539 : 1949
Tensile Strength	6,000 lb./sq. in. average	B.S. 1540 : 1949
Compression Strength	13,500 lb./sq. in. average	B.S. 737 : 1937
Flexural or Cross Breaking Strength	13,500 lb./sq. in. average	B.S. 1539 : 1949
Shear Strength	10,000 lb./sq. in. average	B.S. 771 : 1948
Impact Value	0.5—0.8	Izod M.E.R.O.
Hardness Schlerescope	40	*
Hardness Brinell	37—47	*
	(The average values were taken over six test pieces.)	
Thermal Properties		
Softening or Plastic Yield Temperature	450°C	*
Coefficient of Thermal Expansion	Temperature Interval / Mean Coefficient of Expansion per 1°C: 0°C to 100°C — 9.8 x 10^{-6} 0°C to 200°C — 10.3 x 10^{-6} 0°C to 300°C — 11.0 x 10^{-6} 0°C to 400°C — 12.0 x 10^{-6} 0°C to 500°C — 12.8 x 10^{-6}	N.P.L.
Resistance to Arcing	Average time for penetration 150 secs.	B.S. 1539 : 1949
Resistance to Tracking (Surface Carbonization)	Deemed to be non-tracking	N.P.L. Test
Thermal Conductivity	i. 0.0075 Joules per sq. cm. per sec. for 1 cm. thickness and 1°C difference in temperature	N.P.L. Test
	ii. 5.2 B.Th.U. per sq. ft. per hour for 1 in. thickness and 1°F difference in temperature	N.P.L. Test
Maximum Thermal Shock Temperature	300°C	B.S. 1598 : 1949

See footnote to Table 2.

Applications

Having described the methods of manufacturing both compression-moulded sheets and rods and injection-moulded components, the industrial application of each type can be examined.

Compression-moulded sheets and rods

The hardness, tensile and compressive strength, together with good machinability make glass-bonded mica sheets compare favourably with any other plastics or ceramic insulation available to engineers today. The main uses lie in high frequency applications such as coil formers, struts, panels, commutator segments, contact housings, end plates, oil-filled condenser and transformer covers, and many more uses where low loss factor is important.

Due to glass-bonded mica being non-tracking and arc resistant, its appeal to switchgear designers for use as arc shields and chutes in power frequency application is of paramount importance because the material will not carbonize when arcs form under rupture conditions.

An unusual but important application is met with in 1,500-watt ultrasonic generators designed and built for the continuous production of synthetic blood plasma. Machined glass-bonded mica sheets were found to be most suitable for withstanding the powerful chemical and electromechanical stresses inherent in the production process.

High-voltage condensers of 15 or 20kV. peak working in units up to 5,000 mmF. capacity made from glass-bonded mica interleaved with aluminium electrodes is another example of its utility, particularly as the space saving in, for instance, H.F. induction heating equipment, is considerable. Power factors of the order of .00075 are achieved with a dielectric strength of 500 volts per .001 in. Again, low temperature heating panels, in which nickel chrome wires are sandwiched in the sheet, is another application; outputs of anything up to 2 watts per sq. in. of surface area or 1 watt per sq. in. of each of the two faces is usual.

Apart from domestic uses, such heating panels are installed as desiccators in transmitting, receiving, and radio equipments generally, especially where equipments are left idle for long periods of time such as, for example, on board service ships. Low temperature furnaces or ovens made from several sheets is a further example amongst many more which serve to show their many uses.

To indicate the physical properties of the material, test figures obtained by National Physical Laboratories, Mechanical Engineering Research Organization and other authorities are shown in Table 1.

Injection-moulded glass-bonded mica

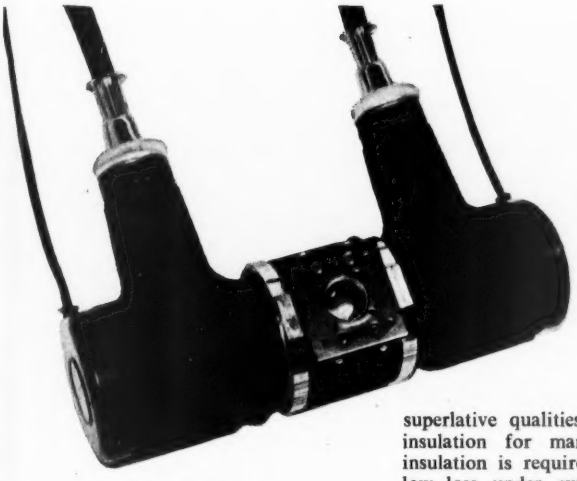
Electrically, glass-bonded mica mouldings are non-absorptive, non-tracking and have a dielectric strength of the order of 500 volts per .001 in. with a power factor of under .002 and a permittivity of between 9 and 11 according to constitution. Thermally, the working limit is nearly 400° C. Amongst their varied uses, many of which are similar to those mentioned under the previous heading of sheet material, there is the unique property of their being X-ray absorptive according to the amount of lead glass used in the composition. To quote an example of this: cathode caps and cable sockets are now being manufactured (see illustrations) with an absorptive equivalent of 25% for an X-ray beam of 100 kV. peak. In other words, the absorptive power of say 4 mm. of glass-bonded mica is equal to the absorptive power of 1 mm. of pure lead hitherto used. Another use is the development of insulators for use as brush holders in electric traction motors and high tension insulators for such equipment as power station electrostatic flue gas precipitators.

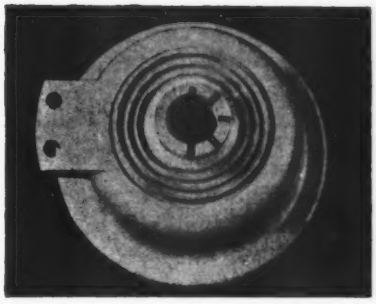
To indicate the physical properties of the material, the N.P.L., M.E.R.O. and other authorities' figures are shown in Table 2.

Table 2. Physical Properties of Injection-Moulded Glass-Bonded Mica.

		Test
Electrical Properties		
Electric Strength	500 volts per .001 in. average	N.P.L. Test
Surface Flashover	19kV between electrodes 1 in. apart	B.S. 1539-1949.
Volume Resistivity	Greater than 10^{14} ohms per cm. cube	B.S. 1598-1949.
Surface Resistivity	5 x 10^{12} ohms per cm. square	B.S. 1539-1949.
Permittivity	15.5 at 1 Mc/s average	N.P.L. Test
Power Factor (Provisional)	.00125 average at 1 Mc/s	*
Mechanical Properties		
Specific Gravity	4.4 average	B.S. 1539-1949.
Tensile Strength	2,000 lb./sq. in. average	B.S. 1540-1949.
Compression Strength	10,000 lb./sq. in. average	B.S. 1598-1949.
Shear Strength	8,400 lb./sq. in. average	B.S. 771-1948.
Impact Value	0.5-0.9	Izod M.E.R.O.
	(Average values were taken over six test pieces.)	
Thermal Properties		
Softening or Plastic Yield Temperature	400°C	*
Coefficient of Thermal Expansion	Temperature Interval / Mean Coefficient of Expansion per 1°C: 0°C to 100°C — 12.7 x 10^{-6} 0°C to 200°C — 12.0 x 10^{-6} 0°C to 300°C — 11.3 x 10^{-6}	N.P.L. Test.
Resistance to Tracking (Surface Carbonization)	Deemed to be non-tracking	N.P.L. Test.
Thermal Conductivity	i. .0088 Joules per sq. cm. per sec. for 1 cm. thickness and 1°C difference in temperature	N.P.L. Test.
	or	
	ii. 6.0 B.Th.U. per sq. ft. per hour for 1 in. thickness and 1°F difference in temperature	N.P.L. Test.
Maximum Thermal Shock Temperature	375°C	B.S. 1598-1949.

The above tests, except those marked * were carried out either by the National Physical Laboratory or by the Mechanical Engineering Research Organization of the Department of Scientific and Industrial Research, and, where indicated, in accordance with the British Standard Specification—see reference in the last column.





(Left) Cable sockets and other insulating components for X Ray equipment are moulded in glass-bonded mica which is X Ray absorbent. (Right) Cathode cap. (Photos: by courtesy of Mullard, Ltd.)

Conclusion

It is the author's opinion that the electronic, radio and electrical industries generally do not yet fully appreciate the superlative qualities of glass-bonded mica insulation for many applications where insulation is required, which must possess low loss under extremes of temperature, pressure, and humidity and be non-tracking and stable under arcing conditions.

The author is indebted to Messrs. Mullard Radio Valve Co., Ltd., Mitcham Junction, Surrey, for permission to publish details of their X-ray equipment mentioned in the article, and to Messrs. Dextran of Aycliffe, Darlington, Co. Durham, for permission to mention their synthetic blood plasma producing equipment. The author is indebted to the directors of the Mycalex Co., Ltd., Ashcroft Road, Cirencester, for permission to publish this article which contains references to tests undertaken for the Mycalex Company by the N.P.L., M.E.R.O. and other authorities.

Courses of Instruction in Plastics Technology

Prospective students are advised to make early application to the colleges concerned for full details of the courses available.

London: Acton Technical College, High Street, Acton, W.3.

Courses for the coming sessions are devoted mainly to the preparation of students for the Associateship examination of the Plastics Institute. They include tuition in the chemistry and technology of plastics materials and plastics machines and mould design. Commencing on September 22, they will extend over a two-year period and will include both theoretical and practical work. The courses are *part-time* and are suitable for chemists or for engineers engaged in industries connected with the production and utilization of plastics materials.

In addition the college is offering a special course of post-graduate lectures on the chemistry of high polymers. Twelve lectures are planned to take place during the autumn term of this year, commencing September 30.

Full details of all courses can be obtained from the Head of the Chemistry and Biology Department.

London: Borough Polytechnic, Borough Road, S.E.1.

The Borough Polytechnic has a large laboratory specially equipped for plastics technology. All the normal technical processes can be carried out on a small work's scale from the preparation of the resins and moulding materials to the fabrication and testing of the finished materials. Two courses offered during the coming session comprise *part-time* day courses and *part-time* evening courses, and a *full-time* two-year course. In the case of the last mentioned, prospective students must have reached the standard of the General Certificate of Education in chemistry, physics and mathematics. All the courses are designed to prepare the student for the examinations held by the Plastics Institute and the City and Guilds of London Institute.

The *full-time* courses commence on September 21 and full details of these and other courses can be obtained from the Head of the Chemistry Department.

London: National College of Rubber Technology, Northern Polytechnic, Holloway Road, N.7.

The college has recently moved into a new building specially erected to provide high level technical education in rubber and plastics technology. The laboratories include a main workshop, a polymer chemistry laboratory and a physical testing laboratory and a considerable quantity of new plant has been installed.

A plastics diploma course is offered comprising a three-year *part-time* evening course for students already holding a General Certificate of Education in chemistry, physics and mathematics at the ordinary level. Students are prepared for the examinations of the Plastics Institute and City and Guilds of London Institute and for the Certificate of the National College of Rubber Technology.

A *part-time* day release course is offered of two years' duration for graduates or three years for non-graduates in preparation for the Associateship examination of the Plastics Institute. This course calls for one day of three three-hour periods per week and one additional evening from 6 to 9 p.m.

Provision is made for suitably qualified students to undertake research and *full-time* courses will be provided if sufficient demand arises. Term commences in September.

Birmingham: College of Technology, Suffolk Street

Courses at Birmingham include *part-time* day studies for the examinations of the Plastics Institute and the City and Guilds of London Institute. The College possesses well-equipped laboratories, and full particulars of dates of enrolments, syllabuses, etc., can be obtained by communicating with the Head of the Department of Chemistry.

Manchester: Newton Heath Technical College, Manchester, 10

Courses are offered both during the day and in the evening for the examinations of the Plastics Institute and City and Guilds of London Institute. In the case of the former Institute a two-year course, *part-time*, is also offered covering the Associateship examination.

Full particulars of courses available can be obtained from the Head of the Applied Science Department.

Stroud: Stroud and District Technical College, Gloucester

The courses offered prepare the student for the diploma of the Plastics Institute and cover a five-year period. During the first three years the student will cover the National Certificate (Chemistry) course or Intermediate B.Sc. Science Course. For the fourth and fifth years courses are arranged on two evenings weekly comprising the subjects of mould design and plastics technology.

Full details of times of enrolment, etc., can be obtained from the Principal of the College.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Plastic-coated Wire Mesh

SIR,—It has come to our notice that plastic-coated wire mesh is being offered in this country. For some considerable time we, as wire weavers, have endeavoured to find a source of supply for plastic-coated wire. Some considerable time ago we circulated an inquiry amongst firms we thought might do something for us but unfortunately at the time the coating on the wire was much thicker than we would desire. In fact, most of the products offered were more in the form of cable, entirely unsuitable for weaving.

Our purpose in addressing you is to ask for your assistance in the matter in the hope that with your contacts you might be in a position to provide us with the names of firms.

THE UNITED WIRE WORKS, LTD.
Granton,
Edinburgh, 5.

Fly Swatters

SIR,—We have an export inquiry for plastics fly swatters and we would be pleased to receive the names and addresses of manufacturers who can supply these.

NEW HYGIENE, LTD.
266-268 Holloway Road,
London, N.7.

Plastics Loose-leaf Binding

SIR,—Enclosed with this letter you will find a small piece of what is known as a "plastic binding element." The sample is of American production and we should be grateful if you could let us know what firms in the plastics industry manufacture this type of binding or could undertake its manufacture.

DRAFFENS OF DUNDEE, LTD.
Nethergate,
Dundee.

[EDITOR'S NOTE.— The binding of the type described is supplied by Nevett, Ltd., Colindale, London, N.W.9; a similar type is made by Purnell and Sons, Ltd., Paulton, Somerset.]

Heating Ovens for Polythene

SIR,—We are contemplating taking up the moulding of polythene for splints. We have had some little experience but are in need of a suitable oven for heating the material, and should be grateful if you would give us the addresses of the firms from whom you would recommend us to purchase such equipment.

ARTHUR VIZARD, LTD.
46 Great George Street,
Leeds, 1.

Refrigerator Components

SIR,—We should be pleased if you would submit the following inquiry to any firms who, you think, will be interested. We are manufacturers of refrigerators and cold rooms and use moulds and beads machined out of timber, and then paint them by priming, flatting and enamelling, reaching a high white finish. We wish to avoid some of the paint work and are interested in acquiring white, highly finished plastic moulds and beadings which would be mainly to three or four patterns, the largest section being approximately 1 in. square., the lengths required being up to 8 ft. and 10 ft.

GEORGE BARKER AND CO. (LEEDS), LTD.
Bramley, Leeds.

Rulers

SIR,—We wish to contact manufacturers of "Perspex" rules 12 in. long embossed on the reverse in ½ mm. on one side and inches and fractions on the other side. We have seen one in use advertising one of our National Airlines and this particular rule we are interested in.

THE RANGER ENGRAVING CO.
292 Humberstone Road,
Leicester.

Solvent for Polythene

SIR,—The use of polythene bottles, as you may know, is becoming increasingly important in laboratories, and we would like to know if you are aware of a solvent for polythene; and also whether you have any knowledge of a cement which can be used for attaching labels to polythene bottles.

GRIFFIN AND TATLOCK LTD.
Kemble Street,
Kingsway, London, W.C.2.

Stereoscopic Spectacles

SIR,—We have published a pamphlet in which is incorporated a two-colour anaglyph illustration of telephone exchange apparatus. The stereoscopic effect is obtained by specially prepared spectacles consisting of a simple black board for the framework, and eye pieces of transparent coloured acetate, or some such suitable material. Naturally one eye piece is blue and the other red, in order that the necessary colour cancellation will result when viewing the two-colour illustration. For a reprint, we want to use a cyan blue and a minus green.

I wonder if, among your readers, there are any manufacturers of plastic sheet material who would be interested in providing us with material of the exact colours and the necessary quality of transparency. If there are, perhaps they would be good enough to contact the Publicity Department of this company, when further details will be supplied.

AUTOMATIC TELEPHONE AND ELECTRIC CO., LTD.
Strowger Works,
Liverpool, 7.

Plastic-covered Springs

SIR,—Would you please advise me of the names and addresses of any manufacturers who can supply coiled springs in various lengths and sizes, with a plastic covering, which is used in the manufacture of toys.

Any help and information that you can give me in this matter would be greatly appreciated.

PLASTA-CRAFTS CO.
6 Brentwood Avenue,
Jesmond,
Newcastle upon Tyne, 2.

Foamed Urea Formaldehyde

SIR,—In an article in the February issue of *Plastics*, reporting on the National Packaging Exhibition at Olympia, it was mentioned that foamed urea formaldehyde was not being displayed and that this material had been a feature of the German Plastics Exhibition.

As we believe that we are the only manufacturers of this material in this country, we wish to take the opportunity of bringing to your kind attention that we are manufacturing this product.

FLORASNO COMPANY.
6 Langland Gardens,
Shirley, Surrey.

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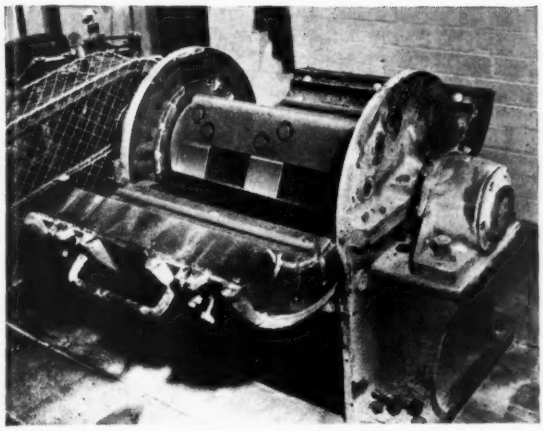
18 YEARS OF EXTRUDED "PHENOLICS"

(*Continued from page 264*)

The most noteworthy addition to the plant in very recent years is in the field of injection moulding. This shop includes a 6-, 10- and 20-oz. Windsor and a 4-oz. Lester machine. As will be noted from the photographs on pages 263-4, there is a great variety of units in plastics materials that serve an important function in the machines. There are some 36 in number (not including purely electrical components) and each is made in the material most appropriate for serving the needs of the job. The materials include polystyrene, methyl methacrylate (Diakon) and nylon, each having been selected after considerable research for exposure to conditions of hard wear for very long periods and to temperature and humidity variations throughout the four corners of the world.

In conclusion we thank the directors of Gestetner, Ltd., for permitting this second visit and Mr. A. de Waele, Mr. Daley, Sr., and Mr. Daley, Jr., for help in the construction of these notes.



Plastics Scrap Materials

Some Notes on Their Treatment and Use

To a lesser or greater extent, scrap is a problem to the majority of moulders and fabricators. In the case of thermoplastics scrap material, it should, from the economic point of view, be used again and there are many moulders and extruders who process material in various ways for re-use. Little has been published on the various methods of re-using scrap material, and only limited information is available on the loss, if any, of mechanical and physical properties for a moulded article produced from scrap material. The following notes have been prepared to throw some light on the situation. (The photograph at left shows a grinding machine open.)

INJECTION moulding machines are getting bigger, and thus aggravating an already serious problem—that of thermoplastics scrap. The bigger the machines, the greater the quantity of scrap in terms of sprue and runners.

Facts and figures on the subject are rather difficult to come by, if only because the problem varies in size so much from plant to plant. However, it would not be an exaggeration to say that for any given shot the discarded material may amount to as much as 60% by weight. Translate this into pounds, shillings and pence in material costs and it will be seen that scrap is big business.

Moulders invariably grind and re-use the sprues and runners from the initial moulding as a routine measure. It is well known that continual moulding of the same powder results eventually in loss of plasticizer, and it is the practice for moulders to dispose of the scrap or to have it reprocessed.

Equally important, however, is a service to industry offering a complete reprocessing service which leaves a reasonable price margin between scrap and virgin material.

At this point it is as well to consider the various problems involved. Scrap material is often, by its very nature, contaminated with grease, metal particles and other factory waste. Before it can be considered as an adequate moulding material it must be entirely free from any kind of dirt or other foreign material.

Summarizing the position it would appear that provided adequate cleaning and regeneration facilities are available scrap material can be converted to a usable moulding compound. All that remains therefore is the question of carrying out this work at an economic price. Apart from the actual process called for, an important consideration is the cost of transportation.

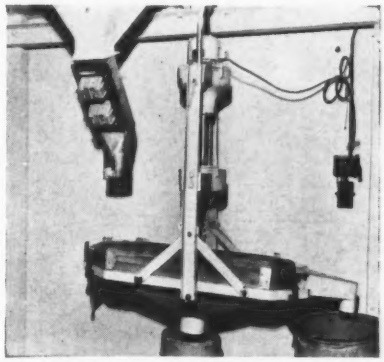
Let us turn for a moment to the actual difficulties which confront the management of a scrap conversion company. One of the chief advantages of plastics is their attractive colours, contained within the materials themselves and therefore dispensing with post-manufacturing operations such as painting. The type of scrap that the management might expect to have to handle will consist of materials in a multitude of colours and it is therefore important that arrangements exist for the proper segregation of the various colours as they are received into the plant. Equally important is the segregation of types of materials. For example contamination of acrylic material with polystyrene would obviously give unsatisfactory results. Whatever efforts the management may make, and however efficient their plant, they are frequently defeated in their primary objective by the moulders themselves, who may pile the scrap indiscriminately on any convenient site in the factory premises, frequently in the open air. We can now see that an essential feature of any scrap conversion plant is a section which sorts scrap as it is received, primarily to segregate the various types of materials, and also to separate colours.

The next stage is the cleansing of the scrap, part of which is normally carried out by hand. Here pieces of rag, paper and other waste are extracted, after which the material is washed to remove dirt and grease. The material is then ready for the conventional re-processing techniques.

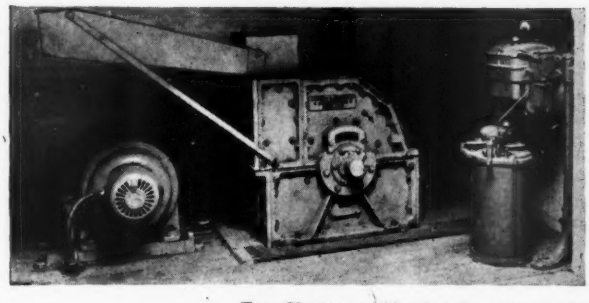
Bearing in mind the points mentioned above, it was interesting to visit the plant of R. H. Cole and Co., Ltd., at Harpenden, Herts, and to study the methods by which these theoretical observations have been put into practice. Some time ago, R. H. Cole acquired a substantial building to which extensions have been added, to give a plant capable of handling a large tonnage of scrap material. On-the-spot responsibility is in the hands of Mr. Penn, a man of great energy, with a gift for enthusing his staff for not one of the most pleasant of jobs. A plant of this kind to be really successful must set the highest possible standard of cleanliness. The various bays are continually vacuum swept during grinding processes to keep them clear of contamination.

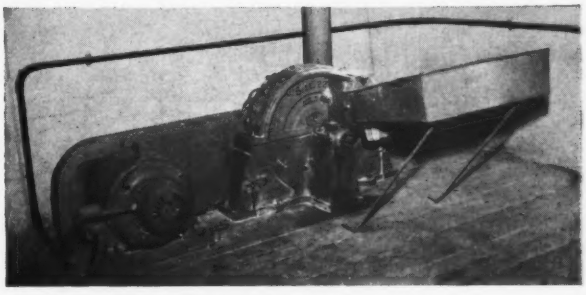
The process employed at the R. H. Cole

(*Continued on p. 292*)



Granulated material from the rotary cutter, mounted on the floor above, is fed by vibratory mechanism to the vibrating sieve, which separates the granules from "fines."





Two Christy and Norris pulverizing machines at the Harpenden factory of R. H. Cole Ltd.

New Productions

Handbags

An unusual type of handbag is produced by M. Shapiro, 10 Sutton Street, London, E.1, by the use of Monoflex flexible cellulose acetate extruded coils which are manufactured by British Celanese, Ltd., Hanover Square, London, W.1. Unusual surface effects and designs can be created by the use of these coils and in the examples shown not only the bag but the slings and zip fastener tab are made by this means. The bags are fabricated in plain colours or in combinations of colours and shoulder slings can be fitted if required. The Monoflex extrusions are available in flat, round, oval or D-section and they find extensive use in telephone flex covering, spiral book binding, basketry and lapping for cane furniture.

Flower Holder

A neat and well-designed gadget, injection moulded in polystyrene, is intended to facilitate the arrangement of cut flowers in decorative pieces in the home. The flower holder consists of two polystyrene lattices, joined together by a removable extension pillar, through which the flowers are placed. For arrangement with short stemmed flowers the extension pillar is not required and may easily be removed. At the base of the gadget a rubber sucker is fitted to keep the holder firmly in position at the base of the bowl or vase. The flower holders, which are manufactured by E. K. Cole, Ltd., Southend-on-Sea, Essex, are available in four colours—crystal clear, pale pink, pale blue and pale green. The retail price is 2s. 6d.

Chassis for radio-sonde equipment

The circular chassis moulding shown in our illustration is moulded by Universal Metal Products, Ltd., Pendleton, Salford, Lancs., for the Plessey Co., Ltd., and is a component of radio-sonde equipment for obtaining meteorological data. The chassis is transfer moulded from a high electrical grade of phenolic material. The holes as well as the 30 narrow reinforced slots for holding the valve pins are incorporated in the moulding. The equipment in which this moulding is used is attached to a balloon which rises 1,000 ft. per min. and bursts when it reaches a height of just over 11 miles. The parachute which is also attached to the equipment then opens so that the instruments descend to the ground. In operation, as the balloon rises automatic signals are transmitted to the operators using radio-sonde sets on the ground. These signals allow the whole flight to be tracked accurately, thus providing valuable data.

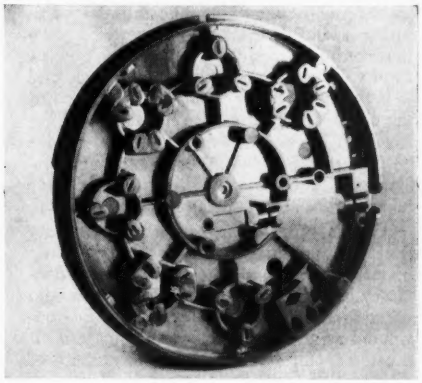
Electric shaver socket

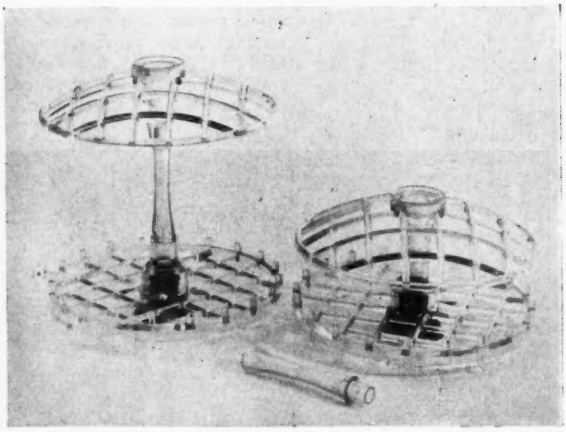
One of the difficulties which has so far retarded the growing popularity of electric shavers has been the difficulty of finding suitable electric current and contact points for the shaver when travelling. Chilton Electric Products, Ltd., Hungerford, Berkshire, who are well known for their Buk and Kub electric shavers, have now introduced a

universal shaver socket intended principally for the hotel trade. The socket provides a convenient means of using shavers of all designs without the need for multiple adaptors and resistances. The socket is made of cream urea, the mouldings being supplied by Hyde Plastics, Ltd., Rookery Way, The Hyde, Hendon, London, N.W.9.

(Left) Handbags made from cellulose acetate extrusions.

(Right) Transfer moulding for radio-sonde instrument chassis.





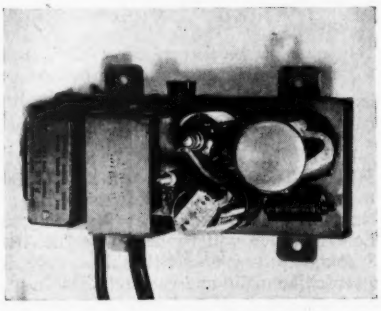
Polystyrene flower holder; (right) the individual moulded components.

Plastics NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

DEVELOPMENTS IN TEMPERATURE CONTROL.—The Tem-Con electronic temperature control system produced by P.A.M., Ltd., of Merrow, Guildford, Surrey, is already well known in the plastics industry for controlling temperatures, particularly in the heating cylinders of injection-moulding and extrusion machines. By this system accurate control of temperature to ±0.2°C. may be consistently maintained. The installation consists of two parts, a sensitive element and a small amplifier. The sensitive element, the size, shape and materials of which are determined by the user's needs, operates a pair of precision contacts. So light is the electrical loading (0.00005 amps.) on these contacts that a movement of two micro-inches (0.000002 in.) is sufficient to actuate the relay, without any of the slight "arcing" which usually arises in expansion-operated contacts. The risk of damage to the contact surfaces, with resulting inconsistent operation, is therefore absent. A positive graduated adjustment is usually fitted in the element head, the range which it covers being chosen to meet the particular needs of the control involved. Setting or alteration of this adjustment under operating conditions to secure the precise working temperature or to meet alterations in conditions is easily effected by hand.

When the contacts are closed, the very small, low-voltage current is amplified by a simple and robust electronic circuit to excite a relay mounted on the amplifier chassis. This relay carries the heating current and may be one of three standard types. No adjustment or control is required by the amplifier, which is enclosed in a compact metal case. It may be installed at the most convenient point and connected to the element by a pair of conductors of any convenient length or type. A 200-250 volts A.C. supply is required by the standard amplifier from which it will draw some six watts in addition to the intermittent heating current passing through the relay. Other A.C. voltages can be accommodated without great modification. Components, including the relay, are mounted in sockets on the chassis; this means that testing and replacement can be done in a few minutes by the operator—or by non-technical personnel.



Tem-Con single circuit amplifier.

Where two or more elements are within reasonable distance of each other, it is economical to use one of the multiple amplifiers, which are made in units suitable for dealing with from two to five independent circuits.

At an exhibition held at Caxton Hall last month a new radiation-type element was introduced, designed specifically for the control of moving hot surfaces such as the rollers of mixing mills, calenders, and embossing rollers.

Tem-Con radiation-sensitive element.

The sensitive element consists of a flat strip of high-expansion metallic foil suspended by its ends in a casing which exposes one side of the strip to the radiation from the hot surface and yet protects it from draughts and other radiation.

The exposed surface of the foil is specially prepared to readily absorb the radiations from the hot surface, and the temperature rise in the foil thus produced causes it to expand and close contacts which, through the Tem-Con amplifier, actuate the relay in the heater circuit. In suitable conditions control to within ±2½° C. is obtained in this way.

It must be emphasized that separate temperature-indicating instruments must be used with the Tem-Con system. This is claimed to have considerable advantages over a combined control and indicating instrument. P.A.M., Ltd., supply a range of thermocouple-operated indicators for use together with the control system.

FIRE TESTS ON BUILDING MATERIALS AND STRUCTURES.—British Standard B.S. 476:1953 dealing with this subject has been revised in the light of experience gained by its use since 1932 and in consequence a number of amendments have been made to the test requirements. Amongst the amendments is an omission of the non-inflammability test. It was considered that a test similar to that given in B.S. 1574, "Flameproof industrial clothing," would suitably represent this test. In the combustibility test amendments have been made in regard to the time of introduction of the specimen into the furnace in order to give the optimum chance of ignition of any escaping gases by the pilot flame. The method of classification of materials in the surface spread of flame test has been amended. The loading of the test for load-bearing structures has been reduced to the same value as the design load. The water test has been deleted. Similarly the impact test has been deleted as it was found not to give a satisfactory measure of the weakening effect of a fire. To assist those wishing to ascertain the probable spread of flame values of material without the necessity of constructing the full-size apparatus required for the surface spread of flame test specified in the standard, a smaller and less expensive type of apparatus has been described in an appendix. This apparatus is not intended to replace that used for the British Standard test and results obtained from it cannot be quoted as qualifying instead of submission to the full-scale spread of flame test. Copies are obtainable from the British Standards Institution, 24 Victoria Street, London, S.W.1. Price 4s.

BRITISH STANDARDS FOR SOLVENTS.—The British Standards Institution has just issued the following eight further standards in the series for solvents and allied products.

B.S.1992, Butyl Acetylricinoleate.
B.S.1993, *sec*Butyl Alcohol.
B.S.1994, Dichloromethane (Methylene Chloride),
B.S.1995, Di-2-Ethylhexyl Phthalate.
B.S.1996, Dimethyl Phthalate.
B.S.1997, Glycerol Triacetate (Triacetin).
B.S.1998, Triphenyl Phosphate.
B.S.1999, Tritolyl Phosphate (Tricresyl Phosphate).

British Standards for these materials were not included in the original series of standards for solvents, although British Standards Aircraft Materials Specifications 2.D.11 Triacetin and 3.D.12 Triphenyl Phosphate previously covered those materials for aircraft purposes. Increased demands for materials of reliable quality for a variety of industrial uses has justified the preparation of Standards for the remaining six products for which no British Standards have previously been issued. Copies can be obtained from the British Standards Institution, 24 Victoria Street, London, S.W.1. at 2s. 6d. each (1993 and 1994 2s. each).

PLASTICS DECK HOUSE FOR ROYAL LAUNCH.—The launch used by Her Majesty The Queen and the Duke of Edinburgh for their recent river trip from the Tower to Westminster Pier was fitted with a special deck house incorporating transparent "Perspex" panels. The launch "Nore," of the Port of London Authority, was converted by Camper and Nicholson, of Gosport, and the "Perspex" components were produced by the Willesden Plastics Department of the Triplex Safety Glass Co., Ltd.

B.I.P. POLYESTER RESINS.—We regret that in our review of the British Plastics Exhibition in the July issue of *Plastics*, page 244, reference was made incorrectly to an agreement between British Industrial Plastics, Ltd., and the Carbide and Carbon Chemicals Co. of the U.S.A. The Laminac resins referred to are, of course, products of the American Cyanamid Co., and it is with this company that British Industrial Plastics, Ltd., have a working agreement on the production of polyester resins. This agreement was first announced in *Plastics*, December, 1952, page 368.

PLASTICS INDUSTRY GOLFING SOCIETY.—The competitions for the *Plastics* Goblets and the Airborne Trophy were held in a rare spell of fine weather at the West Hill course on July 21. Mr. Roland E. Dangerfield, Chairman and Managing Director of Temple Press Ltd., Proprietors of *Plastics*, presented the Goblets to the winners, Mr. C. C. Last and Mr. D. Sullivan.

Results: *Plastics* Goblets.—Winners: C. C. Last (Bakelite Ltd.) (14) and D. Sullivan (Thos. De La Rue and Co. Ltd.) (17), 31 9/16 points. Runners-up: J. M. Davie (Hadley Co. Ltd.) (16) and C. J. French (*Plastics*) (24), 31⅛ points.

Airborne Trophy.—Winner: Desmond Brooke-Hitching (Ranton and Co. Ltd.) (11), 43⅜ points. Runner-up: Charles Parkinson (Chelton (Electrostatics), Ltd.) (5), 37⅜ points.

The competition for the Tom Morris Cup, organized by the North-western Section, was played on Sunday, June 28, at the Knott End course. The society entertained as guests Mr. Nigel Howard, captain of the Lancashire County Cricket Club, and Mr. Ken Grieves, the Australian and Lancashire County all-rounder.

Results: Tom Morris Cup.—Winner: J. H. Smith (13), 71 net. Visitors' Prize.—Winner: K. Grieves (14), 75 net.

NORWEGIAN PLASTICS EXHIBITION.—An international plastics exhibition is to be held in Oslo from May 31 to June 9, 1954. It is being arranged by Forening for Norsk Plastindustri (Norwegian Plastics Federation) and Studieselskapet for Norsk Industri (Norwegian Industries Development Association). Besides Norwegian plastics companies, foreign manufacturers of raw materials, machines and intermediate products are also being invited to participate in this exhibition. The aim of the exhibition is: (a) to show the plastics industry's standing today and the development possibilities in Norway; (b) to inform engineers and technicians from other industries about the industrial applications of plastics; (c) to show the public what plastics are, how they are manufactured and what they can be used for. The price per square metre stand space will be between Norw. Kroner 120 and 140.

GUARDIAN PLASTICS, LTD.—The address of this company has been changed to 76-77 Rahere Street, London, E.C.1. Telephone: Clerkenwell 0634.

BRITISH VISQUEEN, LTD.—Construction has started at Stevenage, Hertfordshire, of the headquarters and factory of British Visqueen, Ltd., the company formed jointly by Imperial Chemical Industries, Ltd., and the Visking Corporation of Chicago, U.S., to manufacture polythene film in Britain. Authorized capital of British Visqueen, Ltd., is £240,000 in £1 shares. Two-thirds will be held by I.C.I. and one-third by Visking.

The chairman of British Visqueen, Ltd., will be Mr. J. C. Swallow (who is chairman of the Plastics Division of I.C.I.) and the managing director will be Mr. N. J. Travis (who is at present on the staff of I.C.I. Plastics Division). Polythene was discovered in I.C.I. laboratories in 1933 and I.C.I. has pioneered its manufacture in film form in Great Britain. Polythene film is transparent, tough, inert, moisture and waterproof and is used for packaging many commodities including foodstuffs, pharmaceuticals, chemicals, electrical and metal components, textiles, machinery and so on.

The Visking Corporation was formed in 1925 to manufacture seamless transparent tubes from regenerated cellulose. During the war, at the request of the U.S. Government, the Corporation developed a process for manufacturing unsupported packaging film from polythene. Today, Visking are the world's largest producers of polythene film.

E. K. COLE, LTD.—Net profit of the group after providing for depreciation and taxation was £134,202 for the year ended March 31, 1953. Final dividend recommendation of 15% is at the same rate as in the previous year but the dividend is payable on the capital as increased by a bonus issue in March, 1953.

MOULDED PRODUCTS (AUSTRALASIA), LTD.—The company's 1952 sales exceeded the previous record by more than 16%. Consolidated profit rose to a record of £119,006 (previous £98,503), excluding £860 surplus on sale of assets. Dividends take £83,507, the ordinaries maintained at 14% taking £69,251 and the prefs. £14,256. To reserve has gone £25,000 again, leaving a carry-forward of £10,690 against £3,247 brought in. Stocks and bank overdraft are both lower than their records of 12 months ago. It should be noted that the foregoing figures are Australian pounds and not £ sterling.

Members of the Swedish Plastics Federation recently paid a visit to the Tyseley, Birmingham, works of Bakelite, Limited. Here, Messrs. F. Ohlin, S. Peterson, J. Flemstrom, T. Forsman and E. Lind are being shown round by A. S. Johnson, of the works manager's department of Bakelite, Limited.

FACE GUARD.—A new shoulder-braced face guard should be of considerable interest to operators of high-speed grinders, drills and similar tools that tend to project articles upwards at high velocity. Manufactured by the Protective Industrial Clothing Division of the R.F.D. Co., Ltd., 35-39 Maddox Street, London, W.1, the transparent, clear or tinted cellulose acetate shield is firmly supported by comfortable felt-lined shoulder braces. A lightweight bib of chemical-proof or flame-proof fabric is attached to the lower edge of the shield to protect the neck and chest. The whole equipment can be adjusted or released in a moment and while wearing it the operator has both hands completely free.

R.F.D. shoulder-braced face guard.

"CONTACT CLEARING HOUSE SERVICE."—It has been realized that while some British and American products are reaching overseas outlets a great many are not, due mostly to lack of capital to expand production facilities, shortages, insufficient raw materials, tariffs and other barriers. The Service is carried on by the U.S. Mutual Security Agency to help British firms to have their products manufactured and sold in the U.S. under licence by Americans and help British firms to manufacture American-type products, using American techniques, patents, formulæ or processes for which there is a demand in the sterling area. Full details of this scheme can be obtained from the Agency's Information Department, at 1 Grosvenor Square, London, W.1, telephone Grosvenor 9000. As examples of the offers open we publish the following:

208 Hy-R-Speed of Los Angeles, California, wish to license European firms for the manufacture of their paint mills and mixers.

211 John W. Meaker of New York, wish to license a European firm for the use of their electro-vent system in leather, paper, plastic and textile goods.

RUBBER TECHNOLOGY SCHOLARSHIPS.—The British Tyre and Rubber Co., Ltd., have endowed scholarships at the National College of Rubber Technology in London which will be known as "B.T.R." Scholarships. A scholarship will be awarded annually and each scholarship will be for three years and valued at £300 per annum.

NYLON EXTRUSION AND INJECTION MOULDING MATERIALS.—Hercules Powder Co. Ltd., of 140 Park Lane, London, W.1, announce that they have concluded an agreement to act as sole distributors for the United Kingdom of Akulon, a polyamide (nylon) type injection and extrusion moulding material manufactured by Algemene Kunstzijde Unie. N.V., of Arnhem, Holland. Several grades of Akulon are supplied for specific purposes each of which possess highly interesting characteristics, such as an extraordinary high softening point, wear resistance and a range of translucent and opaque colours. Lengths of Akulon rod are also offered from stock in sizes between 15 mm. and 150 mm. diameter. Technical literature is available on request.

POLYSTYRENE IN AUSTRALIA.—We understand that Monsanto Chemicals (Aust.) Ltd. will commence the production of polystyrene next October. At the moment Australia imports approximately £1A million per year.

MR. MERVYN JUDE has left the publicity department of British Industrial Plastics Ltd., to join Gilbert Advertising Ltd., Hastings House, Norfolk Street, Strand, London, W.C.2.

MR. R. F. EAGLE who was on the sales staff of BX Plastics Ltd., for over 20 years has recently joined the Hypak Division of the Oppenheimer Casing Co. (U.K.) Ltd. As technical representative he serves in commercial, industrial and export packaging in polythene.

FRANCIS SHAW AND CO., LTD., announce the election to the board of directors at the company's recent annual general meeting of Mr. M. R. Rhodes, the London manager.

BRITISH MOULDED PLASTICS LTD. announce the appointment of Mr. H. H. Callaghan as acting area manager for the Scottish Area of National Plastics Ltd. Mr. Robert Hudson, formerly area manager, has resigned to become managing director of James Grindlay and Co. Ltd., of Bishopsbriggs, Glasgow.

F. A. KETCH AND SON LTD.—After 40 years in Birmingham, this company has now moved to a new factory at Lichfield, Staffordshire. This removal has enabled the company to expand its services and the complete organization, including plastics moulding, is now located under one roof. The Birmingham Depot remains open as a receiving and dispatching office.

GEORGE COHEN, SONS AND CO. LTD. announce the opening of a new plant showroom at Wood Lane, London, W.12. This is equipped with an overhead crane and improved loading and unloading facilities and a wide range of machines of interest to all users, and process plant, is on display.

MATTIS INDUSTRIES, LTD., 4 John Adam Street, London, W.C.2, have been appointed sales representatives for London and the Home Counties for the "Milaflex" range of electrical insulating silks, tapes and cable cloths, manufactured by Miller and Ferguson, Ltd., of Kenmure Works, Bishopbriggs, Glasgow.

BRITISH INDUSTRIAL PLASTICS LTD. has removed the Publicity Department to 1 Argyll Street, London, W.1. The telephone number remains the same, Gerrard 7971.

PEERLESS AND ERICSSON announce that their Head Office has been moved to 1 Carlisle Road, The Hyde, Hendon, London, N.W.9. The new Head Office telephone number is Colindale 8811.

SYNTHETIC FIBRES ON EVEREST.—Readers may remember the "Plastics in the Service of Man" feature devoted to the Boot and Shoe Trade, published in the April issue of *Plastics*. Photographs were shown of insocks woven from polyvinylidene chloride filament. These were being used by Army personnel in Korea. Similar insocks were employed in specially made boots for the recent successful expedition to Mount Everest. The fabric is impervious to acid and cannot therefore be adversely affected by perspiration, and also provides the wearer with insulation against loss of heat from inside. This latter is most important if frost-bite is to be avoided at very low temperatures; the temperature on Everest at an estimated 27,800 ft. where Camp VIII was established was reported to be minus 27° C.

Display stand for crown piece.

CASE FOR THE CORONATION CROWN PIECE.—Many readers will have seen the acrylic pack for the crown piece. Some time ago Mr. Gordon Trill, managing director of Progressive Inventions Ltd., offered to donate the entire profits realized from the sale of a special display stand, in wood, designed to hold the crown piece and its plastics case to the National Playing Fields Association. As will be seen from the photograph, the stand is tastefully designed, being faced in sapelli mahogany. We understand from Mr. Trill that his generous offer has been well rewarded, his company having been inundated with orders for this display stand.

WHEELER AND CLINCH, LTD., announce that as from June 1, the company has been converted to a limited liability company, registered as such on May 26, 1953, number 520045. The company is to carry on the business of plastic mould designing and manufacture and the nominal capital is £4,000 in £1 shares.

BRITISH STANDARDS 1953 YEARBOOK.—The 1953 edition of the above has just been published and gives a list of the 2,000 British Standards current at the end of March, 1953, with a brief description of the subject matter of each. A comprehensive index simplifies reference. The Yearbook gives the usual information on the membership of the General Council, the Divisional Councils and the Industry Standards Committees, together with the names of the representatives on the main Special Committees and Advisory Committees. For the first time a list is given of the British Standards under which the Institution's certification trade marks are used, whilst particulars of the work in hand of all the Industry Standards Committees are also given. Copies may be obtained from the British Standards Institution, 24 Victoria Street, London, S.W.1, price 12s. 6d.

ADHESIVES FOR WOOD, METAL AND PLASTICS.—Bakelite Ltd. have published a very useful booklet which gives detailed information as to the properties and applications of Bakelite adhesives. A complete range of cements is described, together with detailed instructions for spreading and a characteristic chart which lists a series of applications, gives the code number of the correct cement to use in each case and detailed facts as to, for example, spread in lb. per 100 sq. ft., assembly time, strength characteristics, durability, etc.

BOOKS ON PLASTICS

The following books are obtainable from booksellers or from the publishers, Temple Press Ltd., Bowling Green Lane, London, E.C.1.

- **"Plastics, Scientific and Technological"**—3rd Edition. By H. R. Fleck, M.Sc., F.R.I.C. The standard textbook on the chemistry and technology of plastics. 40s. net or 40s. 9d. post free.
- **"Cellulose Acetate Plastics."** By Vivian Stannett. Comprehensive technical survey for the engineer and chemist. 30s. net or 30s. 9d. post free.
- **"Moulds for Plastics."** By W. M. Halliday. Mould designing, construction, operation and maintenance. 30s. net or 30s. 6d. post free.
- **"The Theory of Polymerization."** By H. R. Fleck, M.Sc., F.R.I.C. A book for students, with laboratory exercises and calculations. 10s. 6d. net or 11s. post free.

OBITUARY

We regret to announce the sudden death on July 15 of H. C. Lovell of the Art Department of Temple Press Ltd. whose "exploded" drawings for our "Machines for the Industry" series drew so much praise from both technical and non-technical readers.

Harry Lovell joined the company in early 1913, and saw service overseas during the First World War with the Queen's Westminster Rifles. He was actively associated with Toc H and the Boys' Brigade and his services to the Army Cadet Force earned him the Long Service Medal.

He will be greatly missed by his many friends at Temple Press and in the plastics industry.

Improving the Quality and Efficiency of Plastics Moulding—II

By W. M. HALLIDAY

In this, the second of a series of articles on the Productivity Report on Plastics Moulding, the author discusses the third recommendation made by the team. This concerns an improvement in efficiency by a greater interchange of factory visits, with emphasis on a real exchange of ideas at all levels. The general theme is elaborated to include a discussion on works' libraries, inter-works' conferences and efficiency competitions.

CONTINUING the study of the Report on Plastics Moulding by the Anglo-American Productivity Team it is seen that the team concerns itself greatly with the comparative efficiencies of the industries in Britain and the U.S.

While the team does not specifically state that the general level of efficiency in our industry is noticeably inferior to that prevailing in the American industry, it is clear that their experiences have sharpened their appreciation of our shortcomings and limitations which need to be corrected in our moulding practice and production organization. They are conscious of the many possibilities for improving efficiency, or eliminating inefficiency and wasteful methods in management—worker relations, product design and tooling, and actual moulding production operations.

All the 14 excellent recommendations submitted by the team are aimed to develop greater efficiency generally, but no less than 11 of these direct attention to specific steps which may be adopted with advantage. These 11 recommendations cover such matters as improved management-labour relationships; measures giving workers an increased share in determining and directing managerial policy; developing better training schemes for new entrants and working technicians or designers; the creation of more effective liaison between the many different branches of the industry; greater use of all the technical and research resources available in the moulding industry; greater specialization on products or certain plastics materials by individual companies, and so forth.

One of the most promising suggestions put forward by the team in this connection is the third recommendation (page 70 of the report). It reads as follows:—

> "Improvement of the general standard of efficiency by the greater interchange of factory visits within the industry, with emphasis on a *real exchange of ideas at all levels.*"

The italicized words are the present author's, as these seem to him the crucial objectives to be sought. Inter-factory visits, regarded as pleasant sight-seeing interludes for relieving the monotony of regular business demands and duties, would certainly fail in the real purpose as pin-pointed by the team. On the other hand visits confined to management personnel, designers and technicians would scarcely meet the needs envisaged by the team.

Here one must bear in mind a fundamental difference in practice between the plastics industry in Great Britain and that of the United States; no one could read the report of the team without realizing the greater freedom with which technical problems are discussed between frequently competitive organizations in the U.S.A. In a sense one might almost argue that although the total moulding industry in the States is spread geographically over a vastly larger area than our own industry, nevertheless the industry tends to regards itself as a more coherent unit presenting a unanimous front to its customers. Here the practice for many years has been for companies to restrict rather than encourage the dissemination of valuable technical information to competitive organizations. The reasons for this are obvious and need little discussion here.

The information which follows, however, assumes that a radical switch to something akin to American policy on this matter would bring about benefits which would outweigh the disadvantages outlined above. If this assumption is borne in mind by the reader the recommendations of the team and the discussions by the author will be found to be of constructive value.

To be effective such visits must be organized and conducted so as to be available for all grades of staff and production workers; and particularly to provide all these different personnel with fullest opportunities to exchange ideas, problems, experiences and so on. The visits should be held regularly and at the most accessible points.

The very character of the organization of the industry constitutes one of the biggest obstacles to be overcome in promoting such an effective scheme in inter-factory visits. It has to be borne in mind that many moulding organizations in the industry are small, employing few operatives and often being engaged upon a very limited variety of products. Many of them are situated remote from the main stream of moulding or engineering activity.

This apparently also obtains with the American moulding industry; from the figures given in the team's report it is shown that some 50% of U.S. moulding organizations employ less than 100 employees, whilst only some 22% employ over 200 workers.

Such an organization of the industry must raise difficulties in developing a satisfactory inter-factory visit scheme. Three immediate problems would have to be surmounted, i.e. (1) The kind of personnel to be offered opportunities to make such visits. (2) How such personnel are to be spared from the company employing them to ensure the minimum of dislocation and loss of production to make such visits. (3) How costs of the scheme are to be borne.

For factory visits to be effective visitors should, of course, see the works in actual production. This means that members of the visiting team must absent themselves from their own companies during ordinary business hours. The granting of such leave of absence to a number of key technicians, designers, or production workers might not present any serious objection in the case of a large factory employing say 350 or more workers. With a small organization, however, employing less than 100 workers the question of releasing even a single key individual from his regular design, managerial, or production duties may be an acute problem. To send a number of the staff on such a factory visit might be wholly impracticable for most small works.

It may be said that even the smallest company should find it possible to spare at least one person. This no doubt is true, yet on the other hand, the more limitations are placed on the numbers of personnel making such visits, to that extent will the real objects of the scheme be defeated.

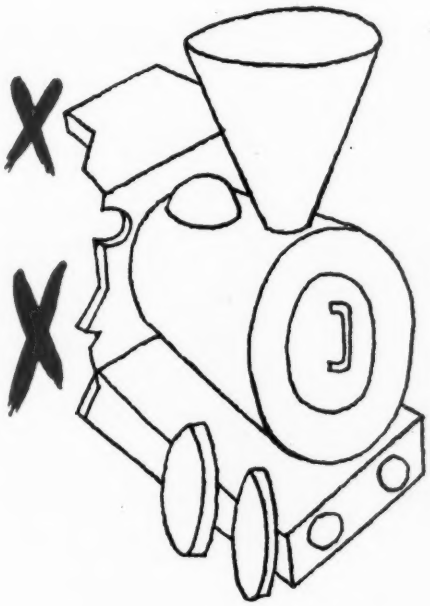
Furthermore, small companies would certainly want to know before participating how such factory visits were to be financed. They might find themselves in some difficulty in meeting such responsibilities, however enthusiastic they may be about the underlying principles.

The difficulties in respect of the location of many companies, i.e., those somewhat isolated from the main engineering or moulding areas, may to some extent be overcome by judicious selection of venues. It should be quite feasible to arrange visits according to regions in various parts of the country, so that travelling and other costs may be kept as low as possible, to ease the financial burden on the smallest companies. But even this would be largely determined by the location of suitable firms to which visits could be usefully made. These, in fact, at present, are usually the larger concerns, who have the necessary facilities for dealing with visitors. The foregoing is not intended as a criticism of the suggestion submitted by the team; but is an endeavour to point out some of the chief points which will have to be elucidated before enthusiastic support can be hoped for from the numerous small moulding concerns. It is precisely these small concerns who will stand to gain most from such inter-factory visits and exchange of ideas.

But this is not the only means available—and possibly not the most effective—to achieve the objectives set forth by the recommendation. There are other ways, some of which certainly offer greater convenience and perhaps lower cost for adoption by the small moulding firm; and some of the following suggestions offered for consideration are free from the three difficulties mentioned above.

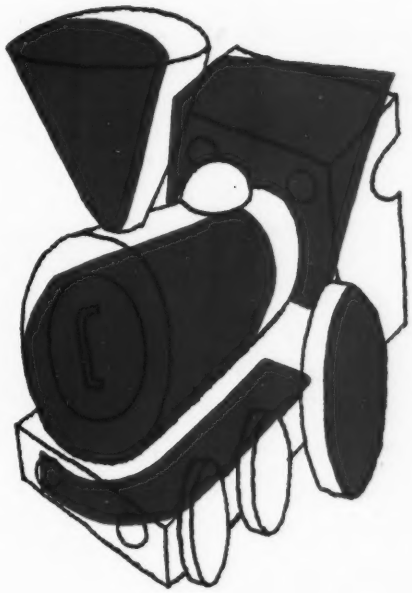
Periodical Literature

Technical journals already find their way to a large number of people in the plastics industry. It is urged, however, that wider circulation of such periodicals throughout a factory would encourage discussion, stimulate interest and function as an effective means of educating the industry's employees



bad business

When this toy is broken (which will be soon) there'll be sharp, *dangerous*, jagged edges. Parents remember — and all plastic toys get a bad name.



good business

This toy won't break in transit — *can't* break with a dangerous jagged edge (because it's made of Courtaulds' cellulose acetate : almost indestructible). Parents remember — and buy more plastic toys.

Courtaulds

cellulose acetate moulding powder

has all these advantages

- ✓ **safe**
- ✓ **extremely tough and durable**
- ✓ **non-toxic**
- ✓ **no fire risks**
- ✓ **unlimited colours**

Courtaulds Technical Service welcomes your enquiries about any aspect of plastics.

PLASTICS DIVISION Little Heath, Coventry. Tele : Coventry 88031.
16 St. Martin's-le-Grand, London, E.C.1. Tele : Monarch 8811.

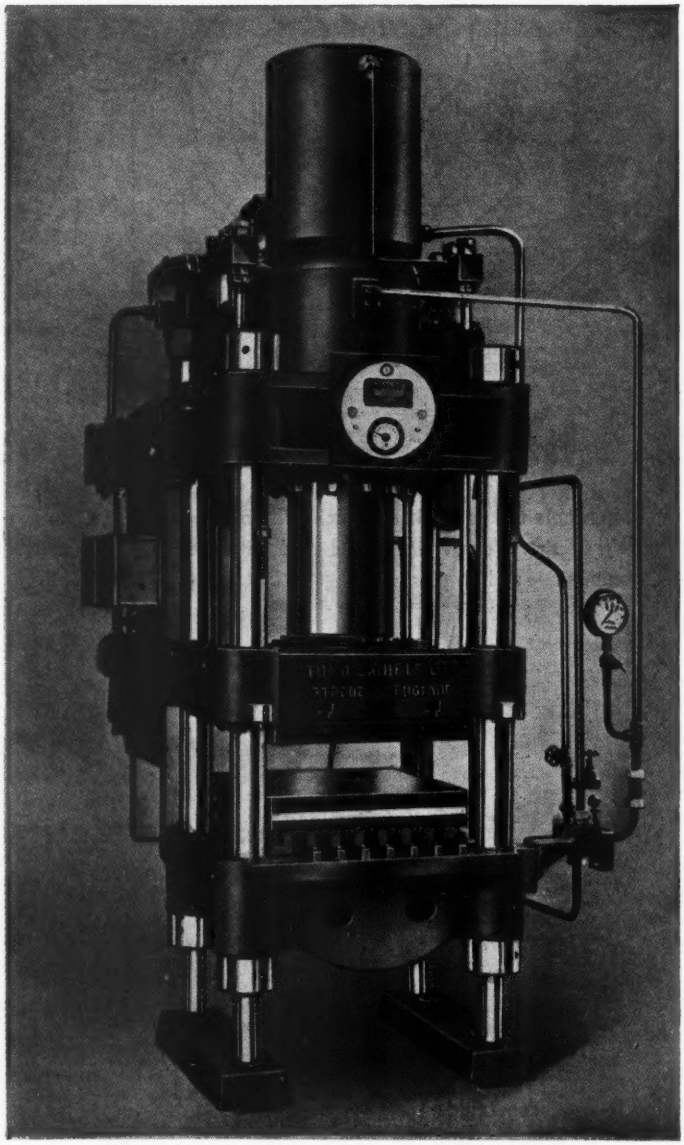
FESCOL processing to lengthen the service from Rams and Packings

It is common for "FESCOL"-processed Rams to operate for many years without sign of deterioration through wear or corrosion, and with packings unchanged.

Rams are deposited in Nickel, or Chromium, to suit the working conditions (advice will gladly be given). To achieve maximum benefit depositing should be done prior to service; rams worn by service can, however, be restored by depositing and thereafter will give the same service as one originally treated. The Ram of the 150-ton Daniels' Press, illustrated, was treated prior to service.

Moulds, also, if "FESCOL"-processed, far outlast untreated moulds. We will be pleased to offer advice on the above and other applications in the Industry.

EXECUTIVES are invited to write for List P.2. which describes the process and illustrates many applications for which it has proved beneficial.



Photograph by courtesy of Messrs. T. H. & J. Daniels, Ltd., Stroud, Glos. The Press is fitted with the Daniels Automatic Process Timer.

FESCOL

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in the full potentialities of plastics materials.

Most large companies publish House magazines, many of which, it is to be regretted, restrict their appeal and material solely to internal matters appertaining to the particular company concerned. An expansion of some of these journals, to include information on new developments, projects and problems, might easily accentuate interest on the part of the employee in his every-day work. Much of this information would be of interest, guidance and practical help to other small concerns, especially those situated in the same locality. It should be possible, given the realization of the need for a free exchange of ideas, and a diminution of the old effete conservatism, still harboured in many quarters unfortunately, to arrange for such House magazines to be circulated to small firms within a specific area. Such magazines would have a local, topical, technical or sometimes even a personal interest for members of numbers of small firms.

It should be feasible to select a number of large companies, preferably those distributed strategically in the main centres of plastics moulding activity, and to arrange for them to sponsor and maintain such a scheme of regular systematic inter-change of House magazines and similar publications

Such a scheme offers innumerable possibilities of extension, not least of which would be that of inviting members of such small organizations amongst which the magazines circulate, to contribute regular articles and notes describing activities, developments or problems in their own works; by running problem sections and so forth. One page might be specially set apart for this purpose.

In this very practical, yet simple way, means would be created for ensuring a real continuous inter-change of information, and a useful forum for the exchange of ideas and problems amongst firms in the same district. These features in the House magazines, of course, would be carefully edited so as not to encroach upon the normal fields covered by the recognized trade magazines catering for the industry as a whole.

From a financial aspect, particularly as affecting the several small firms sharing in such a scheme, costs incurred in purchasing such journals monthly, or any other pecuniary contributions to their production, would be trivial compared with that incurred by allowing numbers of key technicians, etc., to make long journeys visiting works in some distant parts of the country.

Works' Libraries

Another means which is at present available for adoption to the same end is to be found in the numerous excellent technical libraries maintained by many of the larger plastics moulding organizations. Because of lack of space, personnel or funds many small companies cannot achieve much in this important direction by setting up their own technical libraries. Yet their need for regular resort to such facilities is just as great as the larger concern. Access to a well-stocked, up-to-date and comprehensive technical library will often be of tremendous assistance and guidance to designers, purchasers, production or processing technicians.

It should be a comparatively simple matter for most large companies to adapt their library organizations so that its facilities could be extended to designers, technicians and other interested personnel of numerous smaller firms situated in the same district.

Such a scheme, would, of course, have to be planned and controlled at management level; probably by means of a small committee composed of representatives appointed by each of the sharing firms, so that proper safeguards would be assured regarding financial commitments, the actual borrowing of books, etc., and rules.

Where all the companies partaking in such a library inter-change are situated in a relatively small town, conveyance of the required books, etc., could probably be organized by personal messenger. Where the firms are more widely dispersed over a larger area, the postal service could be used.

A scheme of library inter-change of this character, if properly organized, would offer invaluable facilities for a large number of small organizations, who, at present, are unable to institute a library of their own.

Information Services

Here mention should be made of the nation-wide facilities which are already available and about which some firms may be unaware. Principally we have the British Plastics Federation[1] library, which does sterling work in the production of monthly abstracts of articles appearing in a wide range of technical journals. Also included are abstracts of patents. A very substantial stock of text-books is maintained, books being available on loan to members. Bibliographies are published — one such is the recent list of references to articles, patents and literature dealing with polyester and glass-fibre reinforced plastics.

The Department of Scientific and Industrial Research[2] will assist in the provision of information arising from research carried out in its laboratories and field stations. D.S.I.R. also maintains a Technical Information and Documents Unit,[3] collecting and distributing information from Gt. Britain and abroad. Membership of the Association of Special Libraries and Information Bureaux[4] will ensure much valuable help in the tracing of important articles. Mutual Security Agency[5] provides technical information from the U.S.A.

Another service, often overlooked by even the larger companies, is that provided by municipal and county libraries. With the assistance of the National Central Library even the most rare text-books may be obtained on loan. In some areas certain public libraries specialize in the acquisition of text-books on chemical engineering and high-polymer technology. A further development is through the Regional Boards for Industry which are attempting to bring about the closer relationship between local industry and libraries to ensure that the greatest use is made by industry of the library service. These are to mention only a few of the services which can be employed by even the smallest companies, without undue cost. It will be seen from this, that where the smaller organizations could not justifiably maintain an extensive information department and works' library, nevertheless information well suited to its needs is reasonably accessible.

Inter-works Conferences

Much might also be accomplished in the same direction by means of localized conferences, say to be held during evenings, or on an afternoon at week-ends. The initiative for organizing such conferences should be undertaken by the management of some large concern in the town or area, or by a joint committee with members drawn from all firms large and small within the area.

The subjects selected for discussion at such conferences would be technical and practical matters relating to common product or tool designs, moulding procedures, and all kindred points adjudged of useful mutual interest.

If such conferences were to be convened at the moulding works of some participating company so much the better, as this would offer good opportunities for members to tour the works and see actual moulding equipment and processes under discussion.

Subjects for such conferences could be suggested by members of respective companies, and leaders or speakers selected from personnel in the locality. Here again it must be stressed that facilities for such conferences already exist within the framework of the British Plastics Federation. Meetings are in fact held at national and local levels in many spheres of plastics production. It would not be an exaggeration to say that this work is limited only by the financial resources of the Federation and the enthusiasm of the industry. Those companies not already members of the Federation might well consider the advantages to be enjoyed by active membership, and thus make possible greater advancements in this field

Efficiency Competitions between Groups of Companies

Another very useful local action which could be developed far more is that of competitions devoted to specific subjects. It is believed this is quite extensively developed in the U.S. at least amongst general engineering firms. A special topic is selected for the competition, which could well be the design of a mould, or a complete production scheme for a certain moulded product. Essays, or oral discussions and talks are then invited from members of all firms in the locality with a view to obtaining ideas, solutions and information. Prizes could well be offered for such successful candidates, say a visit to some works far outside the locality. Meritorious solutions or contributions would then be circulated amongst competing firms for more widespread dissemination. Such results would be announced on works notice boards, in canteens, reading-rooms and so forth.

Such a competition would also require the appointment of a board of judges; these could easily be elected by managements, or working personnel, foremen, technicians, etc.

Works Efficiency Schemes

Many companies have in operation safety suggestion schemes designed to evoke useful suggestions and ideas from workers on the shop floor for more effective safety promotion. It should be quite practicable for most organizations, large or small, to arrange comparable schemes within their own organization, designed to elicit suggestions

and ideas for improving efficiency. In many cases safety and efficiency are closely allied, thus it might often be feasible to widen the scope of safety suggestion schemes to include efficiency, better production and improved products.

Local Exhibitions

Another excellent plan is to hold exhibitions of plastics mouldings and products in towns where extensive moulding work is carried on by a number of companies.

Such small scale localized exhibitions would serve several useful purposes. Managements, working staffs, designers and technicians would all be drawn into closer co-operation as a result of organizing and holding such exhibitions. All these personages would be provided with greater opportunities of meeting each other on a common ground, when design, material or moulding problems could be discussed, and experiences pooled. The need for such co-operation between individual moulding companies and their respective staffs, is in fact, expressly urged in the team's report, and the benefits to be gained therefrom are obvious.

Such exhibitions could well consist of a display of plastics materials, in the raw state, descriptions of their properties and applications; how they are manufactured by the various moulding or other fabricating processes and so forth. It will often be feasible to have the loan of a few small moulding machines of different types, together with suitable moulds and products, to give practical demonstrations.

Apart from the interest such an exhibition would have for the general public in giving them a more detailed understanding of the kind of industries carried on in their home town, workers engaged in other industries, notably engineering and domestic utilities, etc., would find innumerable items of interest. Such an exhibition would also prove of considerable interest and guidance to many potential users of plastics articles and furnish them with more convenient opportunities of gaining first-hand and reliable knowledge about plastics materials: how they are produced and manipulated, design possibilities and limitations of the product, best service applications and features to be obtained, etc.

Information of this character is of vital importance to product designers and would-be users on the look-out for improved or more economical means of manufacture. Normally most moulding firms go to a great deal of trouble and expense to ensure that such information is placed before prospective users. By means of informative advertising in the press, by technical salesmanship, exhibition of their products at national trade shows and similar activities, they will strive to evoke the interest of potential users in the merits and advantages of plastics.

Well-planned local exhibitions, having the support and co-operation of all moulders and fabricators within the selected area, might easily prove more effective than some of the other more conventional media adopted to this end. Unless a potential user has a specific point of interest, or a pressing design problem, he will be more likely to attend a small exhibition in his own town or city, than make a long and often costly journey to the other end of the country for the purpose of visiting a national exhibition. Thus the local exhibition may easily be more effective in winning the interest and informed co-operation of such prospective users of plastics than the large nationally organized trade show.

The successful development of schemes of the kind here suggested, largely depends of course, upon the measure of interest, co-operation and understanding prevailing between moulding firms in a given locality. This will vary greatly, and may very well be considerable in districts where some large influential and progressive moulding firm is able to display initiative and leadership to the many smaller firms. In other cases, such initiative may have to be stimulated by some central trade organization operating on a national scale to further the interests of the industry as a whole. Societies of this character may help considerably in drawing individual moulding firms closer together to develop activities of the kind outlined.

Many difficulties and objections will have to be overcome before such activities can be inaugurated or planned on the best lines. But as the team carefully points out in its report, the benefits to be gained by closer co-operation between moulding firms and users are of paramount importance to the well-being of the moulding industry, and will be invaluable in promoting greater economy and quality in moulding operations.

Consideration will be given in the next instalment of this series to the four important recommendations proffered by the team on page 70 of the Report covering the ways and means which might be adopted to make actual moulding and tool design more economical.

1.—47-48 Piccadilly, London, W.1. 2.—15 Regent Street, London, S.W.1. 3.—Lacon House, Theobalds Road, London, W.C.1. 4.—4 Palace Gate, London, W.8. 5.—1 Grosvenor Square, London, W.1.

PLASTICS SCRAP MATERIALS (*Continued from page 285*)

plant may be summarized as follows. On arrival the material is weighed, sorted into its various categories and extraneous material removed. Next each individual type of material is sorted for colour and subsequently washed. Finally the scrap is put through the machinery; the machinery employed depending upon the type of material being processed. The extensive plant available includes cutters, pulverizers, grinders and sifters, to cope with all types of scrap from the rubbery p.v.c., polythene and nylon to the cellulosic and resinous products, such as cellulose acetate and polystyrene. There are also special facilities at Harpenden for remilling and colouring cellulose acetate and polystyrene.

The plant and the factory has a logical development and is mainly located on two floors. Scrap material is elevated to the first floor, fed into machines, sieved, separated and delivered into sacks or drums on the floor below. The containers are immediately sealed and are then ready for despatch to the customer or back to the plant from which they came.

The grinding process itself of course is only part of the story. Particles of under a certain size would be unsuitable for moulding purposes and these are therefore extracted by vibratory apparatus. Metallic particles may also be present, both before the material arrives at the plant and also as a result of the grinding process. Such metal particles are extracted magnetically before the material is finally packed.

The work that the plant is called upon to do varies immensely from week to week and one of Mr. Penn's major headaches is putting through a wide variety of materials, in various colours, especially as contamination must be avoided at all costs. The company has two basic approaches to the scrap business. In the first case it purchases outright scrap material from moulders and fabricators. The dump, wherever it is located is inspected and a price is quoted based usually on the quantity involved. Once the price has been accepted the moulder concerned is no longer connected with the material. Thereafter it becomes the sole responsibility of R. H. Cole, who treat it in the light of the type of material it is, its appearance and condition. Frequently parcels of variegated colours are cleaned and then put straight through the grinders. The colour of the end product will of necessity be indeterminate, but there is a market for moulding powder of this kind. Manufacturers use it as a second grade material for cheap lines such as the novelties in Christmas crackers. If the material is of higher standard it will be sorted into its various categories and colours.

The second aspect of the company's work is the service it offers to moulders and fabricators, usually against contract. Here scrap is regularly collected from factories, cleaned, processed and ground and then delivered back to the same factory again for re-use. And here of course the cost depends very largely on the condition of the scrap when it is received.

Scrap that the moulder wants to use again may be divided into two classes; the first consists of sprues, runners and flash and is collected direct from the press. If care is taken, this material can be kept clean, thus eliminating one of the stages when it arrives at Cole's plant and reducing the overall cost of reclamation. The second category comprises rejects of all kinds. Material within this group is nearly always in good condition. It will be seen that the moulder can do a great deal between keeping his costs down for re-processing by ensuring that his scrap is kept as clean as possible, and sorted scrupulously according to colour.

As competition returns to the plastics industry so will appreciation by the moulders of the economic advantages of scrap re-processing increase. We shall watch the development of the Cole plant at Harpenden with the greatest of interest and our thanks are due to the management and directors who were kind enough to conduct us round the company's plant.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2. price 2s. 8d. each (including postage).

B.P. 686,884. Liquid-dispensing closure. A. Savary (Switzerland).

The flexible top has a projecting tube closed by a cap carried by a strip of plastic connected to the top.

B.P. 686,960. Illuminated indicator knob for control panels. To: Bendix Aviation Corp. (U.S.A.).

B.P. 686,981. Production of shaped articles from thermosetting and thermoplastic synthetic resins and material compounded with these synthetic resins in screw presses. Z. Lorenian (Italy).

The material forwarded through a stationary cylinder is prevented from rotating with the feeding screw by longitudinal grooves in the cylinder.

B.P. 686,997. Manufacture of footwear from thermoplastics. To: Carl Freudenberg Kom.Ges.a.A. (Germany).

Combination of thermoplastic material and plasticizer converted to solid state merely by heat results in inadequate strength and rapid wear. The mixture of plastic and plasticizer is therefore subjected to structure-orienting treatment before being rapidly pressed in a mould with 100-1,000 kg./sq. mm.

B.P. 687,024. Machines for delaminating composite web material. J. S. Fridolph. To: Oxvar, Ltd. (U.S.A.).

B.P. 687,072. Manufacture of shaped articles of woven or knitted material made from yarns of nylon. Brocklehurst-Whiston Amalgamated, Ltd., T. H. W. Hulme, V. Castle.

The fabric (brassieres, filter caps) is subjected to gradually and uniformly increasing pressure from a former heated to a certain temperature at which the fibres extend to be permanently set at an extension at which the fabric would normally burst.

B.P. 687,074. Machines for the moulding of plastic material to form bars or pellets. A. W. Sizer.

The rollers and the die have contacting faces which lie on continuous surfaces of revolution and are curved or V-shaped, concave or convex in cross section complementary to one another.

B.P. 687,119. Flanged bobbin with protected edge. I. I. Bliss. To: Acrometal Products Inc.

Cast metal or plastic textile bobbins are inaccurate or insufficiently wear resistant. The new bobbin is built up of a metal barrel with heads of nylon or bakelite. A resin bond is used and nylon gudgeons.

B.P. 687,140. Electric lanterns. General Electric Co., Ltd. I. B. S. Smyth.

The casing of a 5-ft. fluorescent lamp with lengthwise fluted refractor panels in a certain arrangement is made of Perspex.

B.P. 687,145. Method of hardening synthetic resin coatings. To: Kunststoffwerk M. and S., G.m.b.H. (Switzerland).

Dry air heated to between 130 and 220° C. is blown on to the resin layer (" Bakelite "; " Albertol "). The method is of particular interest for the repair of damaged patches of internal tank linings.

B.P. 687,155. Fabric - covered dress accessories such as buckles and buttons. G. E. Wardleworth.

The body is moulded in sythetic resin in a certain shape to trap overlapping fabric edges caught between a plug and body portions.

B.P. 687,265. Resinous products containing chloro-isopropenyl-toluenes. G. S. Schaffel. To: General Tire and Rubber Co. (U.S.A.).

B.P. 687,273. Cold-setting resinous cements. F. R. Himsworth, H. Hughes, I.C.I., Ltd.

Cold-setting phenol formaldehyde resinous cements are made resistant to caustic alkalis by adding aliphatic esters of furfuryl alcohol and of tetra-furfuryl alcohol.

B.P. 687,292. Production of hollow articles from organic thermoplastic sheet material. W. E. F. Gates. To: I.C.I., Ltd.

Doll's heads or bottles are made of two halves in a mould into which fluid pressure is introduced while high-frequency current softens the sheets.

B.P. 687,295. Process for converting polymers into powdered form and the powdered products so produced. To: N.V. de Bataafsche Petroleum Maatschappij (U.S.A.).

The process refers to polymers of unsaturated esters of polycarboxylic acids (polymeric diallylphthalate).

B.P. 687,299. Unsaturated esters. To: Gebr. de Trey A.G. (Switzerland).

A mixture of gluconic acid and di- and trimethacrylates is used as adhesive for bonding a self-setting cast filling of synthetic resin to a tooth cavity.

B.P. 687,310. Process of the production of modified urea-formaldehyde resins. To: Beck, Koller and Co. (England), Ltd. (Germany).

B.P. 687,317. Protection of shoe uppers against soiling, abrasion or the like. S. M. Griswold, H. C. Reynolds. To: B.B. Chemical Co., Ltd. (U.S.A.).

B.P. 687,320. Method of fabricating a tubular article of plastic material in at least two moulding operations. To: Unitubo S.A. (Switzerland).

A thin plastic tube is formed by injection moulding. A plunger is inserted from one end with a pin on top and introduced into, and located by the pin in, a second injection mould where the threaded neck is formed. Polyethylene is a preferred material.

B.P. 687,398. Method of making free-flowing cellular pellets of thermoplastic resins. A. Abbey. Comm. from: Dow Chemical Co.

B.P. 687,412. Collapsible tubular containers. A. C. Anselmi.

A non-resilient deformable metal strip or wire is axially incorporated in the polyvinyl chloride or polyvinyl acetate collapsible tube.

B.P. 687,414. Manufacturer of one- and two-dimensional-shaped articles from cellulose triesters. E. B. Johnson, J. F. Webster. To: Brit. Celanese, Ltd.

B.P. 687,425. Stabilized vinyl resin compositions. To: Titan Co. Inc. (U.S.A.).

Vinyl halide resins are made heat- and light-resistant by a basic lead phthalate.

B.P. 687,495. Keratin-aminoplastic resin Compositions. R. Kveton.

Horn meal or neat's foot meal is treated with a solution of formaldehyde in alkaline medium. The mixture is condensed with amines or amides, the product then acidified.

B.P. 687,526. Alkyl acrylate polymers. J. H. Powell, Jr. To: B. F. Goodrich Co. (U.S.A.).

B.P. 687,530. Thermo-insulated dishes or the like. A. J. Murray.

Aluminium or stainless steel inner platters in an outer platter made from thermosetting plastics with a very thin dead air space between the platters will withstand temperatures (of the inner platter) exceeding 400° F.

B.P. 687,552. Fabrication of pipe from glass fibre and plastic material. Owens-Corning Fiberglas Corp., C. de Ganahl (U.S.A.).

A plurality of helical layers of glass threads coated with uncured plastic material are wound on an advancing mandrel. The plastic is cured on the mandrel, the pipe then removed.

B.P. 687,651. Razor blade dispensing magazine. To: Gillette Safety Razor Co. (U.S.A.).

The magazine may be constructed by moulding (sheet material) from a synthetic resin.

B.P. 687,726. Manufacture of films of regenerated cellulose and other materials. To: La Cellophane S.A. (France).

During the simultaneous drying of superposed films by passing them through a drying machine, the layers of films are one or more times separated and then re-superimposed.

B.P. 687,728. Cellulose acetate solutions and manufacture of self-sustaining films therefrom. C. R. Fordyce, B. E. Gramkee. To: Kodak, Ltd. (U.S.A.).

A solution of cellulose acetate having an acetyl content at 42.5-44.0% is dissolved in a mixture of methylene chloride (82%), methyl alcohol (10%) and cyclohexane (8%).

B.P. 687,733. Container for liquids, granular or powdered materials and method of manufacture thereof. O. Anft (Switzerland).

A triple compartment container with separately made body part, base and top member, which are afterwards attached together, is composed of pressed or moulded synthetic material.

B.P. 687,734. Hardenable condensation products and process of producing same. To: Badische Anilin-und Soda-Fabrik (I. G. Farben A.G.) (Germany).

Certain diurethane products reacted with formaldehyde and alcohols yield on baking hard, elastic films insoluble in water and the usual lacquer solvents.

B.P. 687,761. Caps or gliders for tubular legs or the like supports of articles of furniture. To: United Carr Fastener Corp. (U.S.A.).

The glider is made from a single piece of moulded synthetic organic plastic.

B.P. 687,764. Device for bubble-plate columns. To: Chloberag Chlor Betrieb Rheinfelden A.G. (Germany).

Vapour pipes, bubble elements and locking screws are made of corrosion-resistant material, e.g., of thermoplastic or thermosetting synthetic resin to exclude corrosion of the adjusting device.

B.P. 687,828. Ophthalmic mountings. To: International Polaroid Corp. (U.S.A.).

B.P. 687,873. Shaping of curled plastic strip. G. A. Rowley. To: Nevett, Ltd.

Sheet binding strips are heated, curled around a mandrel and automatically advanced to the coiling device.

B.P. 687,888. Polishing sheets. R. G. Riedesel. To: Minnesota Mining and Mfg. Co. (U.S.A.).

In the manufacture of glass polishing sheets, several synthetic resins are employed for impregnating, sizing, varnish to bond successive layers.

B.P. 687,895. Stoppers and containers associated therewith. M. J. Ibbetson, H. Ibbetson.

The stopper may be of polyvinyl chloride (add. to 655,202).

B.P. 687,905. Coating of masonry materials. A. H. Russell.

A thermosetting resin and pigment composition is applied to a moulded block while the block surface is still hot enough to produce at least partial curing of the resin (add. to 687,842).

B.P. 687,928. Lids for kettles and other water boilers. C. Lacy-Hulbert. To: Simplex Electric Co., Ltd.

B.P. 687,930. Rails for toy vehicles, especially toy railways. E. Fleischmann, J. Fleischmann (Gebr. Fleischmann) (Germany).

B.P. 687,976. Curing process for thermosetting resinous coatings. To: Metropolitan-Vickers Electrical Co., Ltd. (U.S.A.).

The coatings are exposed to the vapours of certain liquids. The latent heat of condensation of the vapour provides the curing temperature.

B.P. 688,021. Methods for manufacturing hollow and solid articles from thermoplastic materials. Z. Lorenian (Roumania).

Outlets to permit air to escape during filling of the mould, admission of cooling means preventing inner vacuum, control of valves for the exact timing of feed of material and admission of vacuum preventing means eliminate difficulties of manufacture and speed up production. The material to be packed (e.g., toothpaste) may serve as cooling means.

B.P. 688,158. Electric contact device for current collection. R. L. Davies, C. C. Howis. To: British Insulated Callender's Cables, Ltd.

The collector insert, e.g., sliding along an overhead wire, is a composite body of metal of good conductivity (copper) and polytetrafluoroethylene finely distributed in the metal.

B.P. 688,173. Adhesive composition. To: E. I. Du Pont de Nemours and Co. (U.S.A.).

The composition consists of chloropolythenes dissolved in an organic solvent and containing a tackifier. It is intended as a bond for bags of polythene film.

B.P. 688,222. Phenol-aldehyde resin adhesives. To: Monsanto Chemical Co. (U.S.A.).

For the manufacture of Douglas fir plywood, a blending of phenol-aldehyde resin syrups and alkali soluble proteinous adhesive base materials provides an adhesive of high thermal reactivity greatly reducing gluing cost.

B.P. 688,263. Composite slabs for use as floor or wall coverings. C. A. A. Rayner. To: Aero Research, Ltd.

A phenolic resin or, preferably because of its lower curing temperature, a melamine resin binder is used in the production of floor tiles or wall panels.

B.P. 688,288. Spectacle frames. G. E. Harris.

B.P. 688,310. Road marking means and compositions. A. J. Myles, E. W. H. Stimson. To: R. S. Clare and Co., Ltd..

Pads of a plastic composition comprising a matrix and light reflecting spheres (glass, Perspex) moulded or cast into shape are secured to the road surface by "Plastaline."

B.P. 688,339. Copolymers of vinylidene cyanide with halogenated butadiene-1, hydrocarbons. S. J. Averill. To: B. F. Goodrich Co. (U.S.A.).

B.P. 688,373. Laminated floor and wall covering material. To: Congoleum-Nairn Inc.

The decorative surface layer consists of 23 parts of a synthetic vinyl polymer plastic resin, 12 parts plasticizer, 65 parts filler applied through a bituminous adhesive to a felt supporting base.

B.P. 688,403. Process for powdering polyethylene. W. A. Haine. To: Union Carbide and Carbon Corp. (U.S.A.).

Polyethylene is heated to softening temperature, then a liquid coolant is worked into it which has a boiling point below the softening temperature and the polyethylene cooled to below this temperature. When mechanically shredded, the polyethylene then forms feathery particles.

B.P. 688,460. Laminated floor and wall covering material and process of making the same. To: Congoleum-Nairn Inc.

Pliable sheets are adhesively attached to a felt supporting base. The sheets of different colour consist of a synthetic vinyl polymer resin, filler and plasticizer and are welded together by heat and pressure along their edges. Satisfactory is a copolymer of 93-95% vinyl chloride and the balance vinyl acetate.

B.P. 688,461. Manufacture of electric circuits. To: Erie Resistor Corp. (U.S.A.).

A metal mesh is formed with patterns making circuit interconnections and provision for receiving resistors and condensers. The components are inserted and plastic insulating material is moulded around mesh and components.

B.P. 688,505. Compositions of matter containing polyvinyl chloride. To: N.V. de Bataafsche Petroleum Maatschappij. (U.S.A.).

Vinyl chloride polymers and copolymers of high molecular weight have valuable coating and film-forming properties. Organosols are used to overcome difficulties of their application. Such organosols with unexpected improved rheological properties are obtained by incorporating into the composition a non-volatile extract of petroleum.

B.P. 688,513. Light-stabilized compositions of vinylidene chloride or vinyl chloride. To: Dow Chemical Co. (U.S.A.).

B.P. 688,514. Process for the manufacture of upholstery material comprising artificial filaments agglutinated by adhesives. To: Vereinigte Glanzstoff-Fabriken A.G. (Germany). (Add. to B.P. 688,315.)

Synthetic resins suitable as binding agents are "Movilith" (polyvinylacetate), "Aconex," "Luthopan." Rubber-like substances are preferred.

B.P. 688,521. Sliding clasp fasteners. E. Sander (Germany) (add to B.P. 681,117).

A watertight or gastight sealing is obtained by a deep engagement of the slide member with grooves in the under-engaging strip. Tilting movement is prevented.

B.P. 688,545. Delivery-spouts for bottles and other containers. Reads, Ltd., K. W. Greggains.

Spout and cap are made, e.g., from polythene.

B.P. 688,611. Brush. R. Loewy, E. Roehrig. To: R. Loewy.

The bunches of bristles are inserted in a carrier of ebonite or a tough plastic material (e.g., "Trolitul").

B.P. 688,619. High-frequency electric cables. J. Day and Co. (Derby Works), Ltd., S. Day.

A flexible cable having a minimum leakage path for television, radar, etc., consists of an integral polyethylene structure with an inner conductor, and outer conductor and straight interconnecting webs produced at one extruding operation.

B.P. 688,625. Dewatering thermoplastic resinous material. To: Wingfoot Corp. (U.S.A.).

The liquid is removed by a non-evaporative method.

B.P. 688,627. Telephone message pads. S. E. Proctor.

B.P. 688,636. Bottle stoppers or closures. British Vacuum Flask Co., Ltd., M. A. Hassid, E. Venis.

B.P. 688,637. Coating of sheet material. To: E. I. du Pont de Nemours and Co. (U.S.A.).

A molten film of a normally solid polymer of sharp melting point (polyethylene, polyamide) is extruded on, and then pressed against, the sheet. While under pressure, the film surface remote from the sheet is chilled to below solidification point of the molten film.

B.P. 688,669. Interlocking wall tile. To: Lincoln Plastics Corp. (U.S.A.).

The tile material may be polystyrene, urea, phenol condensation products, polyesters, alkyds and similar materials to be formed by moulding, casting, extruding.

B.P. 688,709. Book-ends. L. C. Fowler.

B.P. 688,715. Spinning polyvinyl chloride. To: Badische Anilin-and Soda-Fabrik (I. G. Farbenindustrie, A.G.) (Germany).

Filaments, hairs, bristles are advantageously formed from spinning solutions of p.v.c. in water-soluble cyclic ethers.

B.P. 688,729. Pourers for discharging the contents of bottles and other vessels. A. J. Marek.

The pourer, e.g., for refuelling cigarette lighters, is made of a thermosetting or thermoplastic material with pouring beak and air vent.

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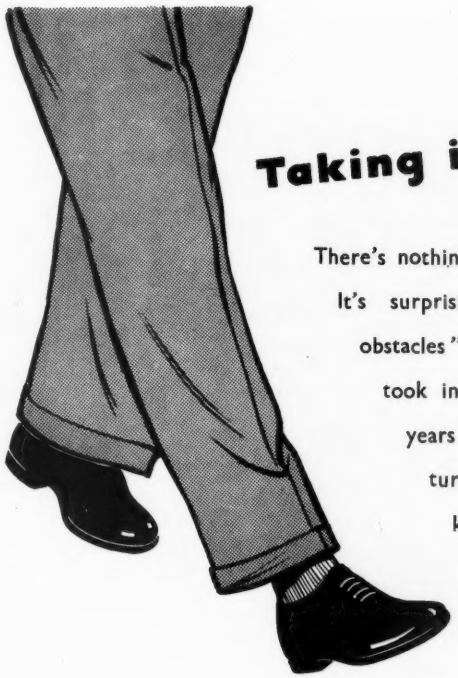

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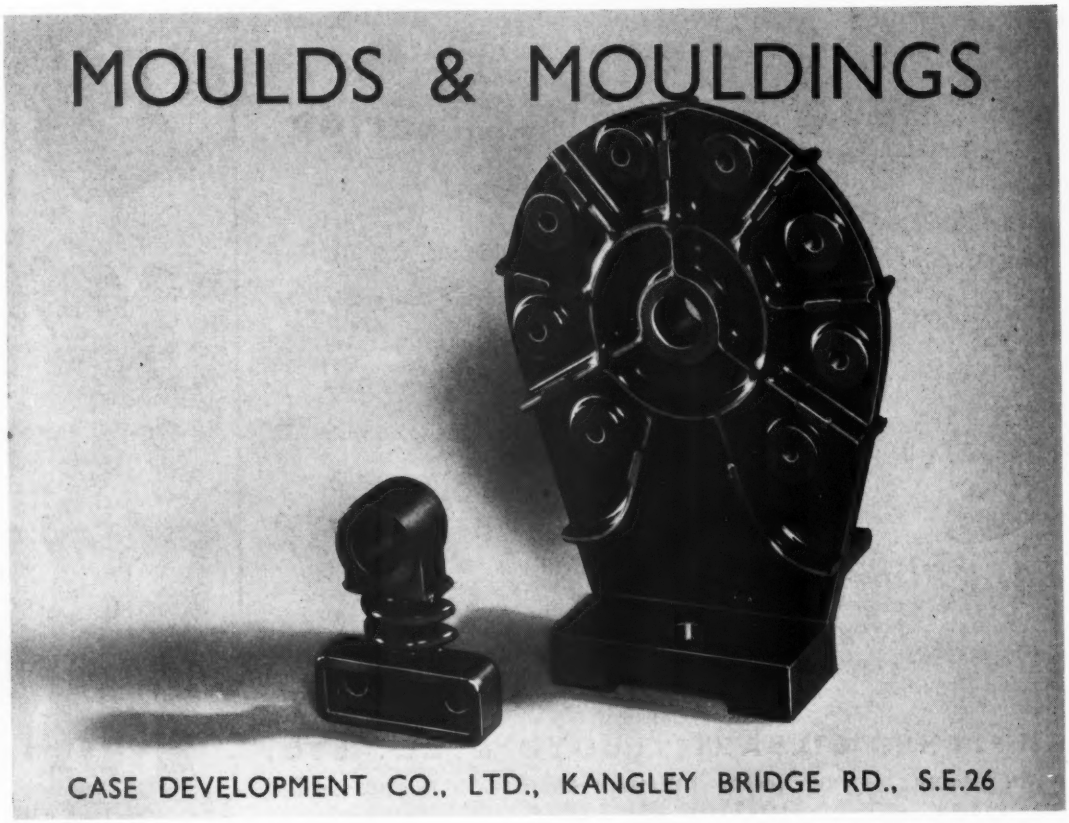
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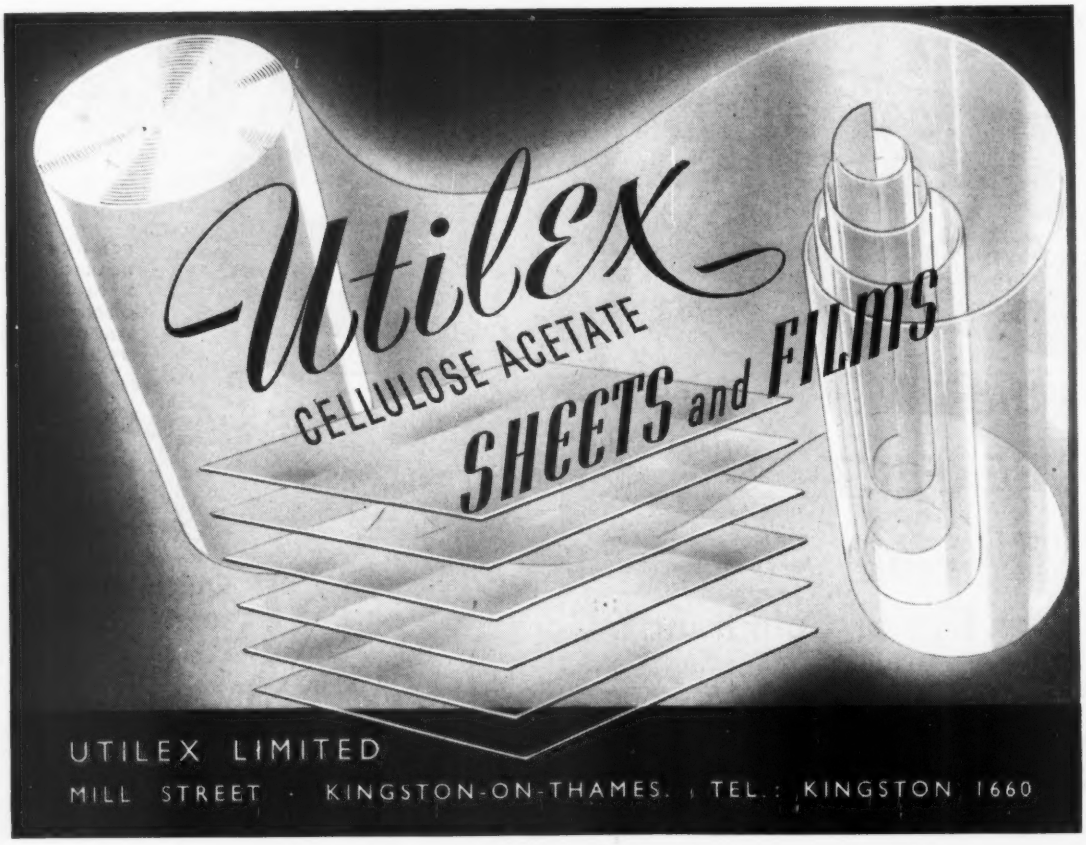
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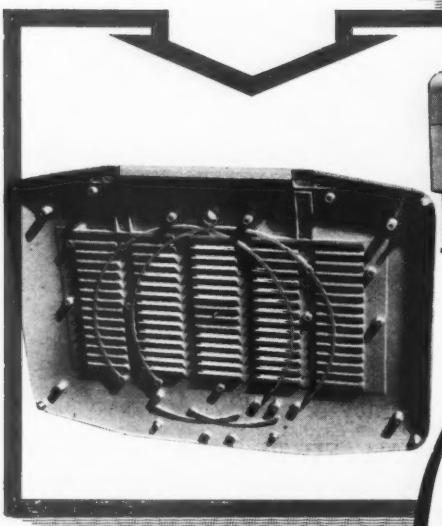

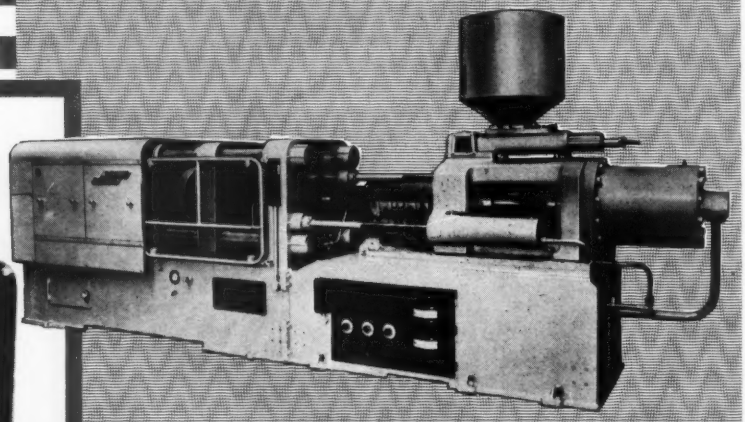

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MATERIAL-Polystyrene
TIME-100 secs. (approx.)

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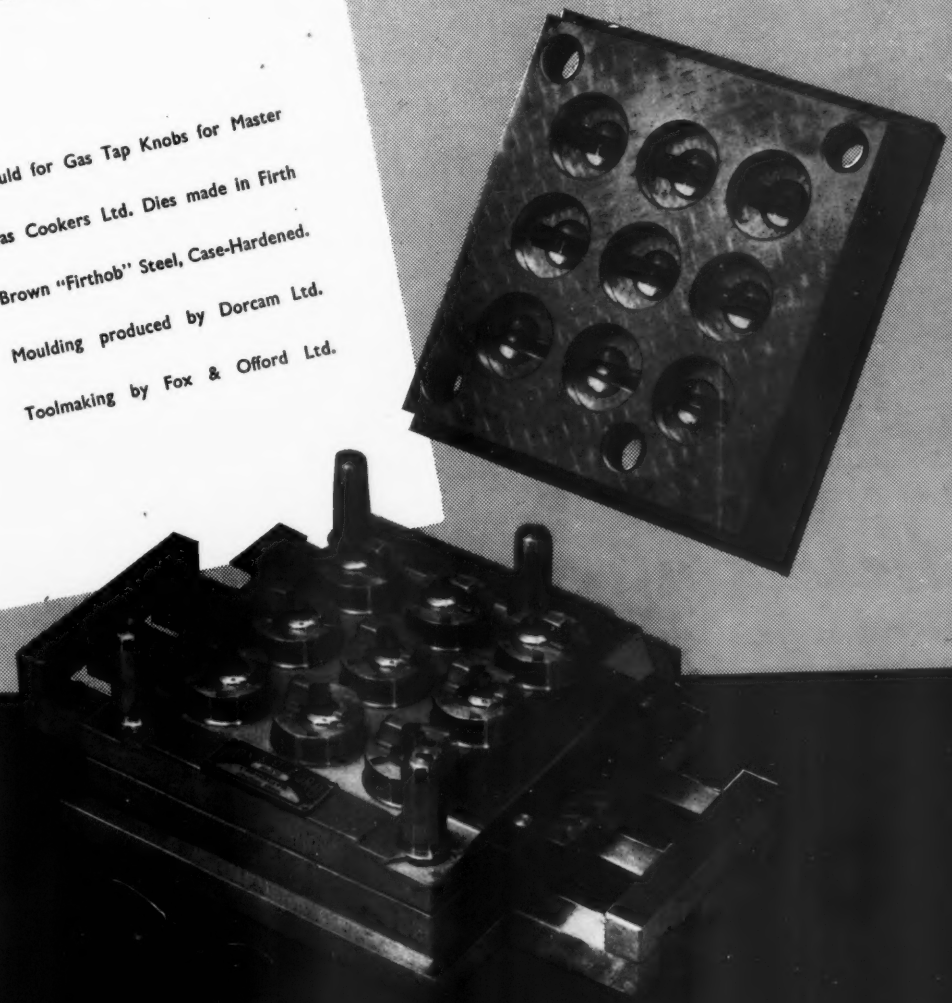

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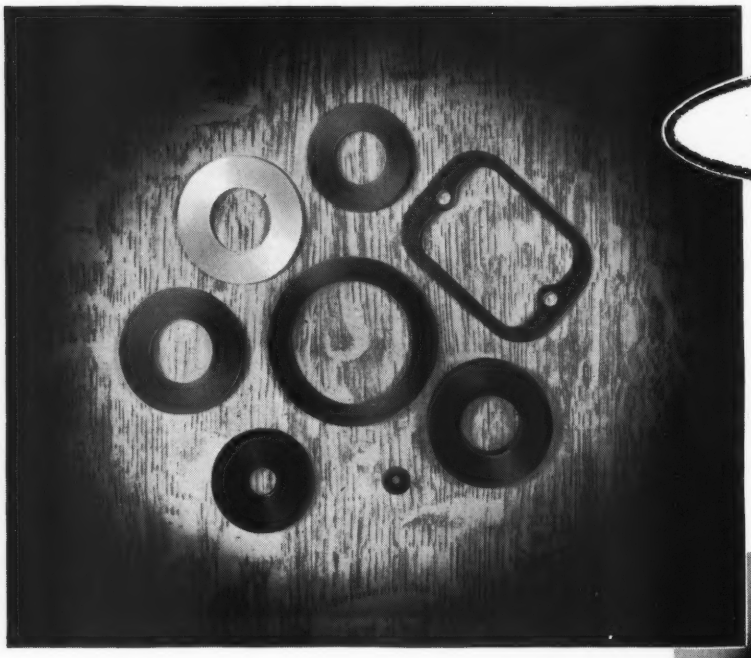

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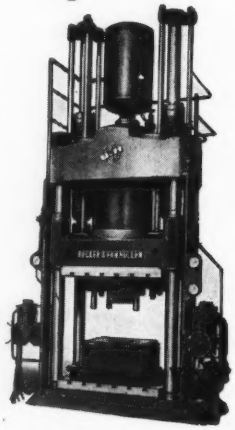

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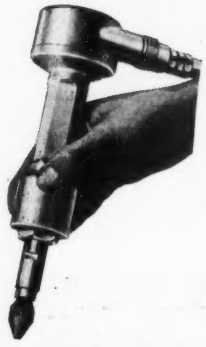

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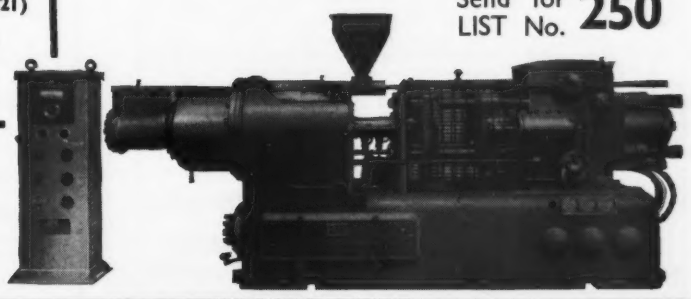

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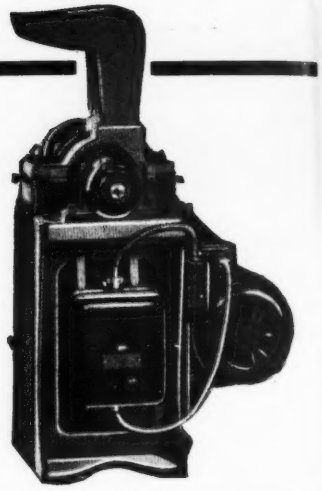

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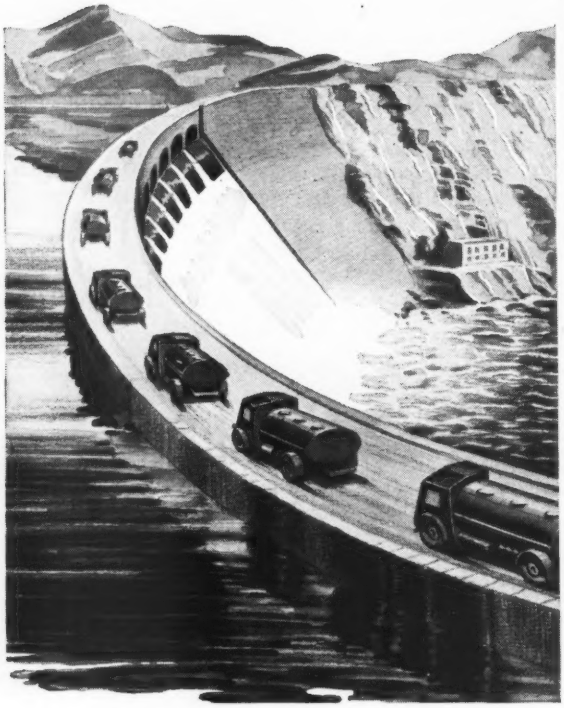

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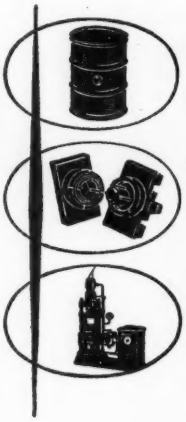

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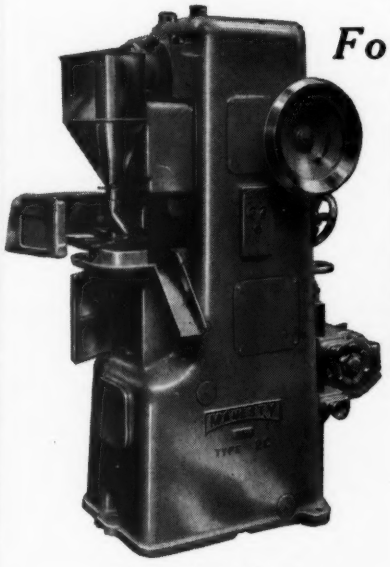

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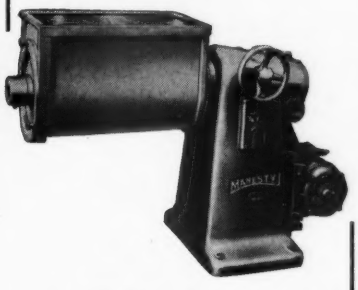

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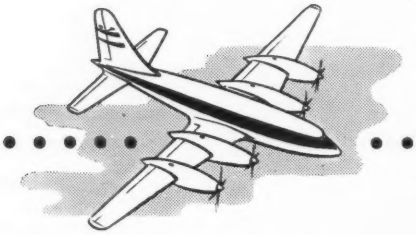

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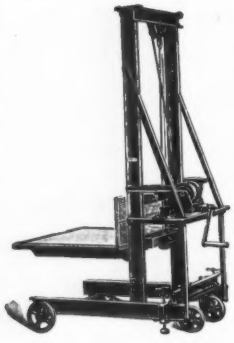

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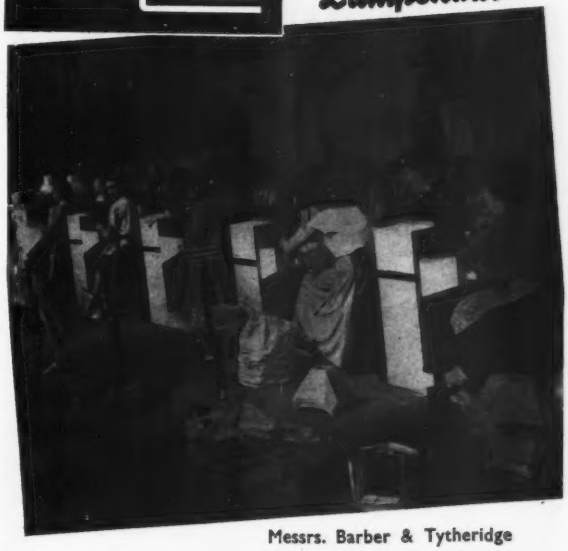

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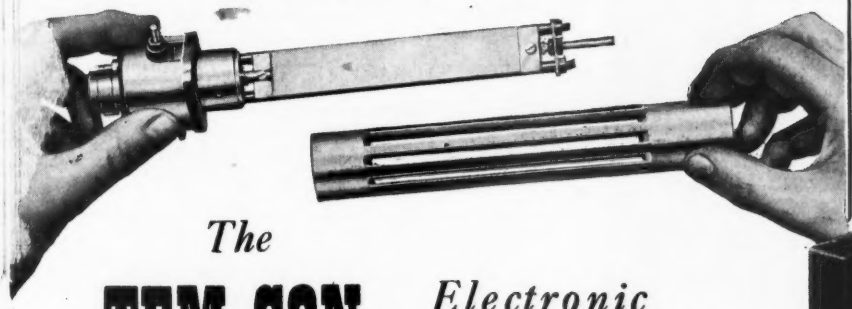

The

TEM-CON *Electronic System . . .*

A robust, inexpensive system, offering standards of fidelity previously unobtainable without high cost, easily applicable to a wide range of humidity control problems. The simplicity of the sensitive elements, and the standardisation of amplifier components enable TEM-CON systems to be built up to suit individual needs at low cost and without delay.

For full details of the TEM-CON system to meet your own needs write to **P.A.M. LTD**

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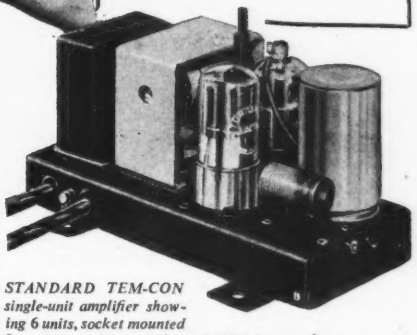
The TEM-CON Humidity Element

The Humidity element is of the Hygroscopic type and its suspension is unaffected by temperature change. Mechanical protection with adequate ventilation is provided by a slotted metal sheath. These controls will operate consistently within ± ½% at 95% R.H. at 110°F. and also in conditions of dryness such as 10% R.H. The elements are provided with an adjustment knob permitting a range of operation of about 40% R.H. and they can be supplied calibrated to operate over that range anywhere between 10% and 100% R.H.



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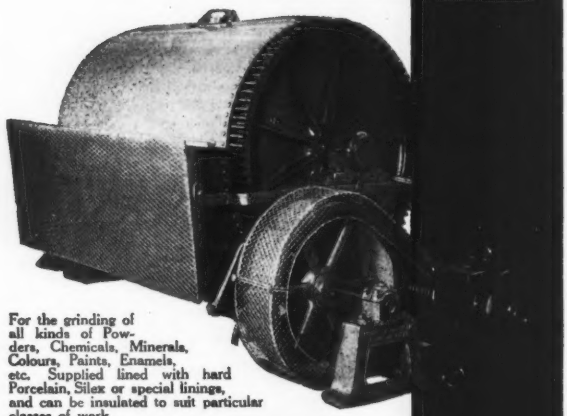

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FOR SALE. A Plastic Moulding company. Four presses, 28-75 tons, fully equipped toolroom. Low rent. Owners retiring. First offer nearest £6,000. Box P9323, care of "Plastics." 193-16

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SMALL TRADE MOULDING shop required, 2,000 sq. ft. minimum, S.E. London preferred. Box P9320, care of "Plastics." 193-22

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ALTERNATORS. Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings ex stock, keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

HYDRAULIC. Frazer Mono-radial pumps, new and second-hand, in stock. Thompson and Son (Millwall), Ltd., Cuba St., London, E.14. East 1844. zzz-440

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Hydraulic Presses of all sizes. Injection Machines, Extruders, Mixing Mills, Hydraulic Pumps and Accumulators.

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75-ton downstroke press by Daniels, 8-in. dia. ram and two 2-in. pullbacks by 12-in. stroke, four columns 23 in. by 16 in. between, table area 36 in. by 33 in., daylight 17 in., W.P. 1½ tons sq. in.

Three 65-ton downstroke presses by Rice, 9-in. dia. ram by 10-in. stroke with single 4½-in. dia. overhead pullback, four columns 13 in. by 13 in. between, table area 21 in. by 13 in., daylight adjustable, 22 in.-18 in., W.P. one ton sq. in.

50-75-ton downstroke press by Plastics and Rubber Machinery, 8-in. dia. ram and two 2½-in. dia. side pushbacks, stroke 14 in., four columns 21¼ in., by 9¼ in. between, table area 20½ in. by 17½ in., daylight 23 in., arranged for pre-filling also with hand-operated bottom ejector gear, W.P. 1-1½ tons sq. in.

Two new 50-ton Coborn enclosed downstroke presses for plastic moulding, 12-in. dia. ram by 10-in. stroke, arranged for pre-filling, steel-fabricated frame, pump, motor, valves and pipes, etc., all totally enclosed, W.P. adjustable 0-1,000 lb. sq. in., fitted two 17-in. by 16-in. electric platens thermostatically controlled, daylight 19¾ in., safety guard.

Several 50-ton upstroke presses by Daniels, 6½-in. dia. ram by 14-in. stroke, four columns 20 in. by 12 in. between, table area 20 in. square, daylight 2 ft., W.P. 1½ tons sq. in.

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Phone, Pudsey 2241. 193-5

WINDSOR S.H.3 INJECTION MOULDING MACHINE, excellent working order, can be seen by appointment. Box P9317, care of "Plastics." 193-24

PLASTIC OR BAKELITE MOULDING PRESS for sale. Brookman open-fronted toggle-action press with dwell at bottom of stroke, reversed by operator, hand ejector, stroke variable up to 5 in., centre to back 7 in., daylight 7¼ in., bed 13¾ in. by 13¾ in., pressure about 8 tons, motorized 230-1-50. F. J. Edwards, Ltd., 359 Euston Rd., London. Euston 4681. 193-7

Machinery, Tools and Plant (contd.)

TWO 300-TON FRANCIS SHAW UPSTROKE HYDRAULIC PRESSES, main ram 14½ in., two 4-in. jack rams, 40-in. stroke, table 36 in. by 25 in., or modified 36 in. by 36 in., 5⅜-in. columns, £995 each.

Sixteen 200-ton ex-M.o.S. upstroke hydraulic presses, 10¾-in. ram, 15-in. stroke, 6¼-in. columns, table 25 in. by 15 in., all-steel head, £875 each.

Sixteen 200-ton ex-M.o.S. downstroke hydraulic presses, 10⅛-in. ram, 15-in. stroke, 6¼-in. columns, table 25 in. by 15 in., all-steel head, £875 each.

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Also other pumps, accumulators, etc., small presses one to 20 tons, control gear, etc. Hodson and Co. (Machinery), Ltd., Spring Mills, Tottington, nr. Bury, Lancs. Phone, Tottington 123-4. 193-38

4-OZ. E.M.B. injection moulding machine, complete with Reavell air compressor, air storage cylinder and full equipment, in perfect working order, can be seen by appointment. Box P9318, care of "Plastics." 193-25

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Also several good-condition toy moulds.

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Cellulose acetate.
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Send now for details.
Cuex, Ltd., 270 Corporation St., Birmingham. Central 5474. 193-42

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BRITAIN'S LEADING STOCKISTS
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HEXAMINE, 10 tons high-grade technical, 1s. 1½d. per lb.
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SCRAP. Offer to:—
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PROMPT CASH OFFERED for virgin and reprocessed cellulose acetate and polystyrene. Give manufacturer's name and packing. Box P873, care of "Plastics." zzz-448

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SURPLUS STOCKS of thermo-setting moulding powder wanted. Send details Box P864, care of "Plastics." 193-1006

WANTED. Perspex clear offcuts, minimum width 3 in., any amount, any thickness, paper covered. Invicta Plastics, Ltd., Queens Rd., Leicester. Phone 78935. 193-1012

DIAKON SCRAP WANTED, clear and clear colours only. Offers to Box P935, care of "Plastics." 193-36

ACETATE SHEETING, 10/1000 in., clear and bright colours wanted. Please write Box P9322, care of "Plastics." 193-18

POLYTHENE, natural, scrap, lumps, reground and virgin wanted. Please offer with samples and particulars to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 193-19

MOULDING POWDERS. We are always buyers of any quantities of injection and compression moulding powders. Please offer with particulars to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 193-20

POLYSTYRENE, clear and coloured, scrap, reground, lumps and virgin, continuously in large quantities required. Please offer with samples and particulars to Herbert Connor, 120 Beaufort Park, Falloden Way, London, N.W.11. 193-21

CAN SOME FIRM OFFER US a non-inflammable adhesive or plastic product for bonding together two pieces of thin chrome tanned leather. Must have reasonable degree of flexibility and give untearable bond. Box P9328, care of "Plastics." 194-1017

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OFFCUTS, PERSPEX, required, ⅛ in., clear or coloured, 1/16 in. clear, minimum width 2 in. Details to F. Blok, 88 Bedford Hill, London, S.W.12. 196-x6552

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The engagement of persons answering advertisements in respect of vacant situations must be made through a local office of the Ministry of Labour, or a scheduled employment agency if the applicant is a man between the ages of 18 and 64 inclusive or a woman between the ages of 18 and 59 inclusive unless he or she, or the employment, is excepted from the provisions of Notification of Vacancies Order, 1952.

EXTRUSION-PVC AND POLYTHENE CABLES. Foreman wanted possessing full technical knowledge, long experience and drive. Small modern shop, good opportunity and wages for first-rate man. State age, qualifications, previous jobs, salary to "E.C.C.", care of Dixons, 1-9 Hills Place, Oxford St., London, W.1. zzz-454

A LARGE MANUFACTURING ORGANIZATION with ample cash resources wishes to develop the extrusion and moulding of plastics, and is looking for a man to take charge of this development.
Applicants should have a sound knowledge of plastic materials and a good practical experience of extrusion and moulding processes. Some knowledge of reinforced plastics would be an advantage but not essential.
The starting salary will be commensurate with responsibility and this offers excellent prospects for the right man with technical knowledge, organizing ability, and drive.
Applications in confidence giving full details of experience and present salary to Box P923, care of "Plastics." 193-26

Situations Vacant (contd.)

CABLE DEVELOPMENT ENGINEER, versed in modern shop practice and experience, required by rubber and plastic cable makers, medium types. Full particulars, age, experience and emoluments required. Apply Box P9110, care of "Plastics." 193-43

PLASTIC COATINGS. A chemist with a wide knowledge of plastic formulations for continuous coating of flexible material is required for research on and development of photographic applications, expert knowledge of appropriate plastics chemistry essential, the work demands initiative and adaptability, factory outskirts N.E. London. Full details and salary required to Box No. N.480, c/o Streets, 110 Old Broad St., London, E.C.2. 193-43

SENIOR WORKS MANAGER invited to join executive of a prominent manufacturing company producing high-grade compression and injection mouldings in self-contained plant in Yorkshire.
This position calls for the highest technical skill, knowledge of modern works administration and an ability to control staff.
Salary will be commensurate with capabilities and the future dependent upon acceptance of responsibility.
Write in first instance giving full personal particulars and details of past experience to Messrs. Smithson, Blackburn and Co., Chartered Accountants, Atlas Chambers, King St., Leeds 1. 193-2

GANDY, LTD., WALLASEY, have a vacancy for a young man with an engineering background to take charge of their experimental production of brake and clutch linings. Some experience of moulding and fabrication of plastics essential. Salary according to age, experience and qualifications.
Apply in confidence for application forms to the Development Manager, Gandy, Ltd., Wheatland Works, Wallasey. 193-3

PLASTICS MOULD DESIGNER required. Write in first instance, stating full qualifications. All applications treated with strict confidence. Only men with sound training and experience need apply.
Write: Messrs. Insulators, Ltd., Leopold Rd., Edmonton, N.18. 193-8

ENGINEERING SHOP FOREMAN, 30-45, must be capable of taking full charge of small, well-equipped shop engaged in the production of moulds, presses and appliances for the rubber trade. Ability to draw an advantage. Permanent position, attractive salary for competent person. Apply in writing, Cannon Rubber Manfrs., Ltd., Ashley Rd., Tottenham, N.17. 194-1015

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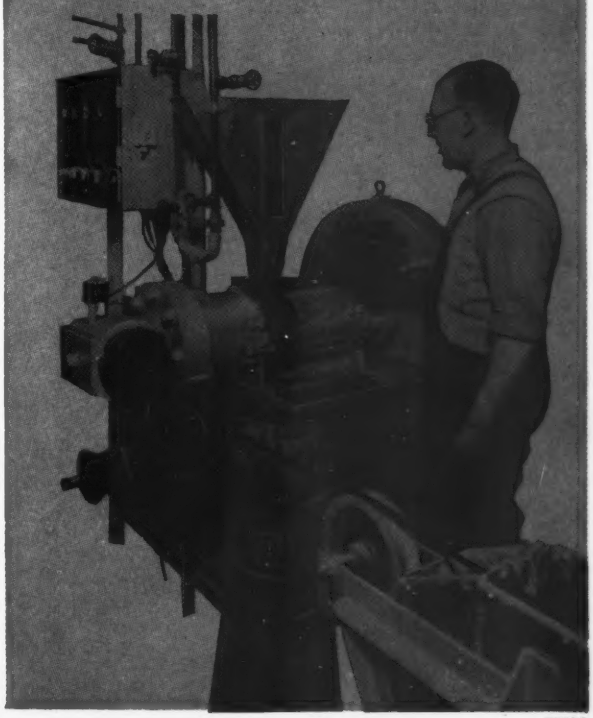

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